Frontispiece.

PLATE I.

Waverley gold district, looking west from Laidlaw hill, showing the even sky-line.

CANADA
DEPARTMENT OF MINES
GEOLOGICAL SURVEY BRANCH

HON. W. TEMPLEMAN, MINISTER; A. P. LOW, DEPUTY MINISTER;
R. W. BROCK, DIRECTOR.

MEMOIR No. 20-E

GOLD FIELDS OF NOVA SCOTIA

BY
W. MALCOLM

COMPILED LARGELY FROM THE RESULTS OF INVESTIGATIONS BY
E. R. FARIBAULT

OTTAWA
GOVERNMENT PRINTING BUREAU
1912

3869—A

No. 1173

LETTER OF TRANSMITTAL.

To R. W. BROCK, Esq.,
Director Geological Survey,
Department of Mines,
Ottawa.

SIR,—I beg to submit the following memoir on the Gold Fields of Nova Scotia.

I have the honour to be, sir,
Your obedient servant,
(Signed) **Wyatt Malcolm.**

OTTAWA, January 7, 1911.

AUTHOR'S PREFACE.

This memoir is to be regarded simply as a compilation, and not as representing, in any way, the result of field investigations by the author. The essential data and facts were gathered from the studies of Mr. E. R. Faribault: who not only assisted in the work of compilation by the impartation of valuable information and by lucid explanation, but, after reading the original manuscript, tendered many useful hints and helpful suggestions. The preparation of the maps and mine plans was, to a large extent, also, under his careful supervision.

CONTENTS.

ILLUSTRATIONS.

Photographs.

Drawings.

Maps.

GOLD FIELDS OF NOVA SCOTIA.

BY

Wyatt Malcolm

INTRODUCTORY.

GENERAL STATEMENT AND ACKNOWLEDGMENTS.

The gold fields of Nova Scotia—the most easterly Province of Canada—occupy that half of the Province lying along the Atlantic coast and extending the full length of the peninsula. The rocks consist of an immense thickness of quartzites[1] and slates folded in long east and west anticlines, and intruded by granite. The ore deposits are in the form of veins which are found aggregated on the domes of the plunging anticlines. Gold was discovered about fifty years ago, and since that time the district has received much attention from geologists of repute. Careful and detailed field work has been done, and many partial reports have been written; but no complete and final report has been presented to the public. The object of the present compilation is to lay before the public a record of the results of these investigations, along with other more detailed information acquired by Mr. Faribault during his many years of labour in the field.

LOCATION AND AREA.

The area occupied by the gold-bearing rocks forms approximately an isosceles triangle, the apex of which lies at Canso, and the base at the western end of the Province. At the eastern end the area is very narrow, but increases in width until at the western end it occupies nearly the full width of the peninsula.

The northern boundary is the southern shore of Chedabucto bay as far as the mouth of Salmon river, the valley of which it follows up

[1] Locally called whin.

as far as Ogden, then after running northwest about 3 miles it takes a southwesterly course to a point 1¼ miles south of Country Harbour cross-roads, thence in a nearly westerly course it crosses St. Mary river near the confluence of the east and west branches and continues in a nearly straight line 1 or 2 miles south of the west branch to a point 8 or 10 miles west of Trafalgar. From this point it runs in a straight line southwest to near Enfield station on the Intercolonial railway, but in this line there is an important break. The rocks of the lower Carboniferous group, which lie to the north, extend in an irregular band up the basin of Gay river and across to the valley of the Musquodoboit up which they extend with decreasing width until they end about 5 miles above Upper Musquodoboit. From near Enfield station the boundary runs in a very irregular line northward about 15 miles, then southwest past Newport station to Avon river at a point 4 miles above Windsor; from there it runs in an irregular line to Wolfville. From Wolfville it extends in a general southwest direction along South mountain a few miles from the Cornwallis and Annapolis rivers as far as Upper Clements on Annapolis basin. From this village to the west end of the basin the northern boundary lies in the Annapolis basin, from which it runs west to the head of St. Mary bay at Brighton. The boundary west from Wolfville is not yet well established; much difficulty has been met by those attempting to determine the dividing line between the gold-bearing rocks and those of undoubted Silurian and Devonian age. Similar difficulty has been met with in regard to two outliers of these later rocks lying a few miles to the south of Annapolis basin. From Brighton onwards the western boundary is St. Mary bay and the Atlantic ocean, and with the exception of some small areas of lower Carboniferous rocks at the head of St. Margaret and Mahone bays, the Atlantic ocean forms the southern boundary. This area includes portions of the counties of Guysborough, Colchester, Hants, Kings, Annapolis, and Digby, all of Yarmouth, Shelburne, and Queens, and nearly all of Lunenburg and Halifax.

The extreme length of the area is about 275 miles, and the width varies from 10 miles at the eastern end, to 40 miles measured along a line from Tangier to Stewiacke, and 75 miles at the west measured along a line from Digby to Lockeport. Its area is estimated at 10,250 square miles, about half of that of the entire Province; of this about 4,000 square miles are underlain by granite and 6,250 square miles by the true gold-bearing series.

Above is given the location and area of what is generally known as the true gold-bearing series, but gold has been found to a limited extent in other parts of the Province chiefly in the alluvium and in quartz veins in crystalline schists at Middle river, Victoria county.

HISTORY.

General History.

The gold mining industry of Nova Scotia is by no means a recently established one, for it has been carried on continually for a half century. During no year since 1862 has work ceased altogether, although there has been much fluctuation in activity and production. The reason for this is that the work is not limited to one field, but the gold-producing districts are very numerous, and while production might fall off or cease in some districts, there never was a complete cessation in the Province. Discouraging results in one district were often offset by encouraging discoveries in another.

Although systematic explorations that led to any marked results seem not to have been made until the middle of last century, there are various reports of some earlier knowledge of the occurrence of the precious metal in Nova Scotia.[1] Heatherington was of the opinion that "The French names of Bras d'Or, Cape d'Or, and Jeu d'Or (now corrupted into Jeddore), strongly confirm the belief that the presence of gold, in those localities especially, was not unknown to the first Acadian settlers. No ancient workings that could positively be recognized as such have been discovered."

It is reported that when roads were being constructed in the thirties at Isaac Harbour and at Sherbrooke, the labourers noticed a bright yellow metal in the stone, but "ridiculed the idea of the 'yellow stuff' being valuable, and used to 'whittle it up' with their knives." A similar report was made with reference to the Ovens district.[2] Canon Gray, who died in 1868, aged 70, stated that as a boy "he had taken gold out of rocks on his father's property near Halifax, and had it melted by a jeweller in that town." It is also reported that gold was washed from the Avon at Windsor early in the century. W. Cook, of Lawrencetown, is said to have found gold in quartz early in 1849, while repairing a dam within a few rods of where it was discovered in large quantities eleven years afterwards.

---

[1] Heatherington. Gold Fields of Nova Scotia, 1868, p. 20.
[2] How. Mineralogy of Nova Scotia, 1868, p. 37.

Richard Smith of Maitland is stated on good authority to have ha in his possession, in 1857, scales of gold from a river in the Musqu doboit settlement.

Some doubt, however, is held regarding the authenticity of som of these reported early discoveries. Pyrite, chalcopyrite, and mic scales have frequently been mistaken for gold, and the excitemen over the gold discoveries of the Province has probably led some me to imagine that glittering particles seen years previously in th streams or in the rock were particles of the precious metal. Th names Bras d'Or, Cape d'Or, and Jeddore were probably suggested by some striking feature such as the beautiful yellow and red colouring of the hardwood forests, or the yellow glow cast by the sunset at th time of discovery, and likely have no connexion with the discovery of gold. The gold-bearing formation is not to be found at Cape d'Or nor around the Bras d'Or lakes. The Avon river flows for only a very short distance over rocks of the gold-bearing series, so there is little probability of its sand being auriferous

None of the above discoveries, if authentic, led to the establishment of any mining industry, and the first careful explorations were made by John Campbell, who, being prevented from making a trip to California, conceived the idea of searching in his native province for the precious metal. In 1849 he succeeded in panning gold from several places along the shore, and in 1857 washed it from the sands at Fort Lawrence, Halifax harbour. He had such faith in this source of the metal that he procured a license to prospect and mine the sands of Sable island, but the government offered such illiberal terms that the undertaking was dropped. Later investigations showed that the sands of some of the rivers of Cape Breton island are auriferous. Alluvial mining, however, never assumed very great proportions. The sands on the shore at the Ovens were washed in 1861 and 1862; the ancient conglomerates at Gays river were mined for a few years, chiefly in the seventies; a lot of surface material was crushed early in the nineties at Moose river, Lake Catcha, and a few other places; and washing has been carried on to a small extent in other places, but no important industry was ever established.

Probably the first discovery that resulted eventually in the establishment of the gold industry in Nova Scotia was that made by Lieutenant C. L'Estrange, who while moose hunting in that part now known as Mooseland on the Tangier river in September, 1858, found

traces of gold in the quartz of that district.[1] In May, 1860, John G. Pulsiver of Musquodoboit, accompanied by Joe Paul, one of L'Estrange's Indian guides, happened upon the same spot, and found a great deal of quartz carrying gold. On his way to Halifax to report his discovery he noticed other districts that appeared promising to him, one of which he pointed out to Peter Mason, who made a discovery in October, 1860, at the head of Tangier harbour. Samples shown to the government officials in 1860 failed to convince them of the value of the discoveries; however, the rush of people into Mooseland and Tangier in the spring of 1861, and the numerous discoveries made, forced them into action, and Mooseland and Tangier were officially proclaimed gold districts and surveyed in April, 1861.

The great excitement that prevailed at Tangier with the opening of spring, 1861, spread into other parts of the Province; men recognized a similarity in character between the rock at Tangier and that in other localities, and, though nothing was known of the geological structure, the summer of 1861 witnessed the discovery of gold in a large number of the important mining districts, Sherbrooke, Wine Harbour, Lawrencetown, Oldham, Waverley, etc. These regions, in which the auriferous quartz was found, were proclaimed by the government as mining districts, and surveyed into areas of uniform size, which were leased to the miners.

There has been much variation in the degree of activity manifested at different periods in the history of the gold industry. The year 1861 saw a wild stampede into the mining districts and during the winter[2] "many hundreds of areas were taken up by persons who had never seen even the surface soil of the tracts they applied for," and when the melting of the snow in the spring failed to reveal an abundance of gold glittering upon the surface of the rock the would-be miners were discouraged. Very few had had any experience in mining, the majority were looking for fabulous wealth, but were soon undeceived, and many of those who were successful in discovering auriferous veins expected them to consist wholly of rich ore, and became discouraged as soon as lean ore was struck. The small size of the areas, especially at Tangier and the Ovens, made it impossible for any person with capital to pursue a mining policy, and hampered the individual miner. The areas were generally 150 feet by 250 feet, but at Tangier they measured only 20 feet by 50 feet, the smaller

[1] Heatherington. Gold Fields of Nova Scotia, p. 27.
[2] Hamilton. Report of the Chief Gold Commissioner, for 1863, p. 3.

dimension being along the vein. It was impossible for the miner get rid of the water, and operations were necessarily very expensiv The result was that in the summer of 1862 there was a depression the industry which reached its lowest ebb in the autumn.

This was followed by a gradual change in the mining policy pu sued by different operators. Individual work on small areas bega to fall off, owners of adjoining areas united their forces and opera tions were thus more economically carried on. There was a ten dency for many small areas to pass into the hands of one operato and mining companies acquired blocks of land on which an economi cal mining policy could be outlined and pursued. While the num ber of lessees decreased, the number of areas worked increased. Thu almost immediately after the depression in 1862 came a gradua revival of the industry, which culminated in wild excitement in 1867 and 1868. In 1867 the production reached 27,314 ozs. 11 dwts. 11 grs. It was a period of speculation; American and English speculators aimed at getting rich quickly by fair means or foul, with the result that gold mining in Nova Scotia received a blow from which it took fifteen years to recover. Production fell off until in 1874 it amounted to only 9,140 ozs. 13 dwts. 9 grs.

Inquiry was made into the causes of the decline, and the following were considered by Selwyn as most prejudicial to the progress of the industry[1]:—

"1st. The rash expenditure of capital in the purchase of mining rights respecting the actual value of which nothing is known with certainty.

2nd. The hasty and inconsiderate erection of costly machinery for mining and treating the ores, before their quantity or their probable value has been determined.

3rd. The attempts frequently made to enhance the value of the stock by declaring dividends, sometimes paid out of capital, but often by means of a process commonly known as 'picking the eyes out of the mine,' or in other words selecting all the rich material to secure a few high yields which are far in excess of anything likely to be the future average.

4th. The too common, almost universal practice of devoting the whole of the net proceeds to the payment of dividends, and having no reserve fund to meet expenses when poor ground has to be worked through........

[1] Geol. Sur., Can., Report of Progress, 1870-71, p. 277.

5th. The small size of the 'areas' or claims, not as regards actual acreage, but in relation to the position and thickness of the veins. This necessitates a wasteful multiplication of shafts and plants of machinery for crushing and dressing the ores. . . . .

6th. The disregard of the natural features of the ground, shown in locating the crushing and dressing machinery without reference to the easy delivery of the material from the mine and the fall required for the perfect treatment of the ores, and for getting rid of the tailings. . . . . .

7th. The almost universal want of any appliances for saving pyrites and fine gold."

In addition to these, Hind mentions some other causes such as[1]:—

1st. Frequent incompetency of some of the so-called mine managers.

2nd. Ignorance of managers regarding the pay-streaks.

3rd. Neglect to preserve records and plans of work done, which are absolutely necessary for acquiring a knowledge of the ore-shoots.

In 1872 a great change took place in the system of mining; operating by companies was almost completely discontinued, and the system of working the mines by tribute was introduced, became very general, and was the chief system in vogue for a decade. It is briefly this: two or three practical miners take over a mine for a stated period and agree to pay the owner a percentage of the value of the gold extracted, trusting by the exercise of economy, and the elimination of pilfering of high-grade ore by dishonest miners, to make a fair profit on their venture. The introduction of this system resulted in a decrease in the number of workmen. At first, it seemed to promise fair results and a number of leads that had been abandoned by companies were re-opened, but it was not long before it was seen that it was attended with serious disadvantages.

While the system kept alive the industry, it prevented the carrying out of any well defined mining policy in the way of development or preparations for economic continuance of mining. The main object was to follow the pay-shoot and remove the ore as economically as possible without regard to the future welfare of the mine. Timbering was inadequate or neglected, waste rock was allowed to fill the old workings, necessitating excessive initial outlay for any com-

[1] Report on Sherbrooke Gold District, p. 60.

pany who would in later years wish to re-open the mine. plans or records were kept and thus most valuable information w lost; information, which a new company intending to re-open t mine would be glad to get. The upper parts of veins were moved where they were found to be auriferous, and thus the roo of the mines were destroyed, making the control of surface wat for future mining a serious problem. Under this system the extra tion of the gold from the quartz was frequently very crude ar resulted in much loss. There was also the loss resulting fro carrying on operations on a small scale and from the lack labour-saving machinery.

During the seventies the introduction of dynamite was attende with favourable results.

[1]In 1883 and 1884 several successful attempts were made b men of experience and training to re-open mines that had been idl for ten or fifteen years, and the year 1885 saw a marked increas in the production, which amounted to 22,202 ozs. 12 dwts. 20 grs This success was due in a great measure to the practice of clos economy, the application of scientific principles by men of intelligence, and the introduction of modern methods, and better machinery and mills. So economical had the operations become that large bodies of low-grade ore, yielding from 4 to 6 dwts. per ton, were mined with profit. This period of prosperity continued for a number of years. In 1893 and 1894 there was a decided decrease in production, followed immediately by a marked increase, and from 1896 to 1903 the yield was over 25,000 ounces per annum, and in 1898 reached the maximum, 31,104 ozs. 17 dwts. During these latter years much attention was given to the concentration of the tailings and their treatment. The chlorination process was first tried, but met with little success; the introduction of the cyanide and bromo-cyanide treatment, however, led to the recovery of much gold that had formerly been lost.

The production dropped from 25,198 ozs. 4 dwts. 18 grs. in 1903, to 14,279 ozs. 18 dwts. 14 grs. in 1904, and has since remained very low.

It is believed by many that the future of gold mining in the Province is involved in the question of carrying the operations to greater depth than has been customary. The similarity between the interstratified veins of Nova Scotia and the saddle reefs of

[1] Hardman, J. E. Canadian Mining Manual, 1892, p. 18.

Bendigo, Australia, and the fact that the latter have been profitably worked at a depth of 3,000 feet,[1] has led to the belief that a policy of deep mining in Nova Scotia should be carried out. To test the advisability of pursuing such a policy the Legislature is prepared to offer substantial assistance in sinking a vertical shaft to a depth of 2,000 feet. If it be proved that under intelligent management profitable mining can be carried on at that depth a fresh impetus will be imparted to the industry which will carry it through many more years of successful activity.

Others, however, are opposed to a policy of deep mining, and are of the opinion that the future of the industry lies in prospecting and opening up new veins, and in re-opening mines that were not exhausted.

To attempt to revive the industry a measure was passed by the provincial government in April, 1909, whereby the Governor-in-Council was authorized to render assistance in cross-cutting and driving levels at such depths and for such distances as might be approved of by the Inspector of Mines or an engineer selected by the Department of Mines; also to render assistance in the utilization of water-power with the object of reducing as much as possible the cost of gold mining.

Previous Work.

Although the slates and quartzite along the Atlantic coast received some attention from the earlier geologists, and there was some speculation as to their age, it was not until after they were made important by the discovery of the auriferous quartz veins, that they were brought prominently to the notice of the geologist.

Among the earliest investigators were Jackson and Alger, Gesner and Dawson. Judge Haliburton in his "Historical and Statistical Account of Nova Scotia," 1829, describes these rocks as consisting of clay slate and trap, the latter sometimes showing apparent interstratification with the former, but generally occurring in confused masses. In "Remarks on the Mineralogy and Geology of Nova Scotia," 1833, Charles T. Jackson and Francis Alger gave a brief description of the clay slate and the quartz rocks of the Atlantic coast. They considered the quartzite, which they found to alternate frequently with the slate, as contemporaneous

[1] The Australian Mining Standard, Nov. 18, 1908, p. 556.

with it, and in no way of the nature of trap. These sedimenta rocks were regarded as later than the granite. Notes were ma regarding the weathering of the strata and the character of t resultant soil. Pyrite was mentioned as of frequent occurrenc and mention was also made of some veins of quartz on the we coast. The work was accompanied by a geological map on whic the slates were marked as "Transition Clay Slate"; a few banc were laid down to represent "Quartz Rock alternating with Cla Slate."

In 1836, Abraham Gesner published his "Remarks on the Geology and Mineralogy of Nova Scotia," accompanied by a map In this the different rocks were described, and notes given as to their location. The granite was classed as Primary, and its mineralogical composition was described. The gneiss and mica slate, which he found lying adjacent to the granite in many places, were regarded as having been exposed to intense heat, and were classed as Transitional. In some places the slate or quartz rock was found lying on the granite, while in other places the clay slate was seen to pass into gneiss and mica slate. The clay slate was found to alternate with the quartz rock, which on account of its greater resistance to weathering frequently formed ridges and mounds. The quartz rock was described as hard, compact, brittle, and heavy. In some places the slate was found to be crystalline, sonorous, compact, and highly pyritiferous, and was hence called "ironstone." The clay slate was classed as Transitional, that is, it was regarded as among the most ancient of the sedimentary rocks.

Although Gesner described the slate as overlying the granite and carrying inclusions of the latter, yet he showed a tendency to regard the granite as intrusive in the slate, tilting the strata at high angles, breaking up the beds and cutting them with intrusive dykes.

The boulders scattered over the surface of the Province were regarded as due to great floods and to the violence of volcanic explosions.

As regards the occurrence of economic minerals he remarked[1], "it will be safe to affirm, that that portion of the Province which is occupied by the slate, contains ores of the most useful and important kinds."

[1] Geology of Nova Scotia, Gesner, p. 65.

"A Geological Map of Nova Scotia with an accompanying Memoir" by Gesner, was presented to the Geological Society of London in 1843, but the map was not published until 1845, when it appeared in Vol. I of the Geological Journal. In 1836, Gesner included the fossiliferous iron-bearing rocks of the South mountains in his slate division, but in this he drew a distinction between the fossiliferous and the non-fossiliferous. In "Industrial Resources of Nova Scotia," 1849, he classified the rocks along the Atlantic coast as granitic or hypogene rocks, and stratified, non-fossiliferous rocks of Cambrian age.

The appearance of Dawson's Acadian Geology in 1855, showed that the author had done some close observing in his study of the "Granitic metamorphic" district. In this work the different rocks are described and are classed as granite, gneiss, mica-slate, clay-slate, and quartz-rock or quartzite. The granite, of various textures, sometimes porphyritic, is of deep-seated igneous origin, and the gneiss and mica-slate in contact with it are regarded as much altered sedimentary rocks. The slates and quartzite, the general strike of which is northeast and southwest, are considered as resulting from sandstones and clays; in fact, all the rocks except the granite are looked upon as metamorphosed sandstones and clays. There are intermediate forms between the different classes mentioned. Some attention is given to a discussion of the age of the rocks. The glacial drift is accounted for by the transporting power of floating ice, the land being supposed to have been pretty generally submerged.

The excitement produced by the discovery of gold in California and Australia led to the report of similar finds in Nova Scotia, but the opinion is expressed that the finds were not authentic and that some mistook pyrite for gold. "Quartz veins, however, occur abundantly in some parts of the district, and it would not be wonderful if some of them should be found to be auriferous."

Later editions of "Acadian Geology," in addition to the above, give a description of the gold deposits, and in the supplement to the second edition occurs a discussion of the age of the slates and quartzite with the conclusion that they are probably Cambrian. The relation of the granite intrusion to the auriferous veins also receives some consideration, and the suggestion is made that while granite dykes cut the quartz veins, the formation of the veins and the granite intrusions are roughly contemporaneous.

Shortly after the discovery of the auriferous veins the p
cial government in 1861 commissioned Henry Poole to m
geological report on the gold districts in the western part
Province, and J. Campbell to report on those of the east.
visited the known discoveries and a great many other places
the gold-bearing series was exposed, and in 1862 submitted a
in which he mentioned not only the places where discoveries
been made, but promising districts for prospecting. Cam
made two reports, one in 1862 and the other in 1863. He wa
first geologist to recognize the real structure of the series. O
had regarded the alternate wide zones of slate and quartzite
ning east and west as successive interstratified beds, but C
bell was the first to observe that they were not a succession, b
repetition of beds. He noticed that the strata in broad ba
dipped alternately north and south at high angles, and conclu
that they were folded in long lines of elevation or anticlines, wh
were parallel and had about the same trend as the coast. He noti
too a second folding, which produced a plunging in the long e
and west anticlines. According to him the series was composed
two groups of rocks of great thickness, a clay slate group sup
imposed upon a quartzite group. The gold veins were observed
lie chiefly in the bedding planes of the lower group on the dom
portions of the anticlines or where the anticlines plunged to t
east or west. As the veins frequently crossed the bedding
regarded them as of later origin than the containing rocks. I
called attention to the great erosion that had taken place and di
cussed the probability of finding valuable alluvial deposits. Durin
his investigations he carefully examined the sands and gravels of
great many streams on the mainland and in Cape Breton and re
ported on the results. His second report was accompanied by
section across the gold-bearing series from north to south, showin
the folded character of the rocks.

Although Campbell, on account of the short time at his dis
posal, did not make a detailed examination of the rock structure
and thus in his section omitted many folds, which are shown on
the map accompanying this report, yet much credit is due him for
his close observation. By calling the attention of the public to
the dependence of vein distribution on the structure of the rock
he pointed out the great importance of a knowledge of the geology
of the fields. The necessity of detailed maps showing geological

structure was emphasized by later observers, and thus the seed sown by Campbell bore fruit in the elaborate maps and plans that have been produced by E. R. Faribault of the Geological Survey, Canada.

D. Honeyman contributed a great many papers on the geology of the Province to various periodicals and to the Nova Scotian Institute of Natural Science. Many of these deal with the lithology and distribution of the gold-bearing series, the nature of the Gay River conglomerates, the distribution of surface boulders and the direction of their transportation.

T. Sterry Hunt spent a few weeks with A. Michel in the gold fields in 1867, and his report was published by the Geological Survey of Canada in 1868. In this report was given a description of the geology, the auriferous veins, and the methods of mining and milling, together with notes on the individual districts. Hunt was a strong exponent of the theory that the interstratified quartz veins were deposited on the sea bottom contemporaneously with the sands and clays. In his description of the individual districts he gave the location, the salient geological features, and the extent of the mining and development work that had been carried on and was in progress at the time.

A. R. C. Selwyn spent several weeks in the gold-fields during the autumn of 1870, and his report appeared in the Report of Progress, 1870-71, Geological Survey, Canada. He pointed out the necessity of detailed and accurate mapping, considered the origin of the granite and its age, the age of the gold-bearing series, the origin and structure of the auriferous veins, and the probability of the occurrence of valuable alluvial gold deposits. He suggested that the granite was formed by the fusion of the sedimentary rocks at a time later than the deposition of certain Silurian and Devonian rocks that exhibit alteration at points of contact. From a consideration of the mineralogical characters and physical aspect of the rocks, as well as from palæontological evidence, he concluded that the gold-bearing series was of Cambrian age. He dealt at considerable length with the question of the origin of the veins, strongly opposing the theory that they were contemporaneous, and agreeing with Campbell in the opinion that they were formed by infiltration into crevices formed along the bedding planes. He was strongly of the opinion that, on account of the extensive erosion that had taken

place, scientific and persevering exploration would reveal p that could be worked with profit.

A man who did very careful and detailed field work in the years of the gold industry was H. Y. Hind. He was commiss by the Legislature to report on certain gold districts. Re were made on the gold districts of Waverley (1869), Sherb (1870), and Mount Uniacke, Oldham, and Renfrew (1872), and were accompanied by sections and large scale plans in which topography, the rock structure, and the location of the veins represented in detail. The geology of the districts was descr as well as the veins and the work that had been done on them, suggestions of economic importance were given with reference to development of pay-streaks and to metallurgical operations. question of the decline of the industry also received his consid tion. Although he acknowledged that the folding processes effe much change in the structure of the interstratified veins, and a tain amount of rearrangement of the mineral constituents brought about, yet he was of the opinion that the most of th veins were contemporaneous with the rocks. So convinced was of this that he considered the possibility of correlating the qua veins of one district with those of another. He regarded the gr masses of granite as really metamorphosed sedimentaries of Laur tian age, and the gneisses and schists, lying adjacent to the gran and now known to be metamorphosed equivalents of the slate a quartzite, were regarded as of Huronian age, and intermediate point of time between the granite and gold-bearing rocks.

In 1881 an arrangement was made by which the provincial go ernment was to share with the Geological Survey the cost of thorough topographical survey of the Nova Scotia gold-fields, an to that end work was begun at once by Wm. Bell Dawson, but wa discontinued at the end of the year because funds were not pro vided by the local government for further work. From his work topographical maps were made of the area including the districts o Lawrencetown, Waverley, and Montague, and large scale maps o these districts were also made, but none of them were published.

In 1890, work was begun by L. W. Bailey, for the Geological Survey, in the southwestern part of the Province, and was continued for several summers. Details of his work will be found in some of the Summary Reports, but more particularly in the Annual Report of the Geological Survey, Vol. VI, Part Q, and Vol. IX, Part

M. These reports are accompanied by maps showing the topography and geology on the scale of 8 miles to 1 inch. The report Part M. Vol. IX, which is more detailed than the other, describes the geology of the southwestern part of the Province. Some attention is given to the topography and the surface geology, and to the dependence of the country's industries on the character of the glacial deposits. The rocks of different areas are described and the sedimentaries are divided into three great divisions, "Black Slate," "Banded Argillite," and "Quartzite." The metamorphic rocks near Yarmouth which had been considered by some as possibly of different age from the slates and quartzites, received some close study, and the conclusion was reached that they are only altered equivalents of the gold-bearing series, which varies quite a little in composition. The report closes with a brief description of the most important mining districts.

Detailed work was done by J. E. Woodman, in the Moose River district, and his description of this district was accompanied by photographs, diagrams, sections, and plans showing topography, geological structure, and the location of the veins. The geology, mineralogy, and vein structure are minutely described. Woodman has also contributed other papers on the gold-bearing series in one of which he gives suggestions as to classification and in another of which he discusses the question of age.

The man who has contributed more than any other to our knowledge of the gold-fields of the Province is E. R. Faribault of the Geological Survey. He has spent many years in field work studying the geology and ore deposits, and in mapping and constructing plans and sections, and is to-day regarded as the authority on the subject.

In continuance of the policy of mapping Nova Scotia on a scale of 1 mile to 1 inch, the work, which began in Cape Breton, was carried to the mainland in Guysborough in 1882. Faribault was engaged in this work under H. Fletcher who was in charge until 1885, when the task of mapping the gold-fields was entrusted to the former. The work which began in the east has been carried westward, and is still in progress. The map of the Province is being published in a series of sheets, each of which represents an area 18 miles by 12 miles, is numbered and bears some characteristic name as "Windsor Sheet," "Tangier Sheet," etc. The numbers on the sheets correspond to those on the index map of the gold-fields.

The field-work and compilation for these sheets has been
well into Queens county, and the publication is as far west as
sor and Mahone bay. Most of them are accompanied by
verse, geological sections. On these sheets—which can be pr
by applying to the Geological Survey, giving the number of t
desired, or stating the particular locality of which a map is wa
is marked the topography, culture, and geology. The elevat
lakes, points on rivers, hills, and important places are given on
of more recent publication. Geological boundaries are traced
and strikes are indicated, the synclinal and anticlinal axes and
faults traced, and the quartz veins and ore deposits marked.
bogs, swamps, roads, buildings, etc., are indicated.

[1]A further work, suggested by J. Hardman and started by
bault in 1897, was the publication of large scale plans and se
of the most important mining districts, and in all twenty-six
been published. These are published on the scale of 250 feet
inch, or 500 feet to 1 inch. They show the topography,
houses, mills, and the blocks and areas. The geology is give
detail, with the dips, strikes, and faults. The quartz veins,
ferous and non-auriferous, are indicated together with their
the dip of the rolls and the direction of the pay-streaks, the t
ness of the veins and the shafts that have been sunk on each
gether with their depth, as well as other matters of interest to
miner. These plans have proved of the utmost value to the mi
man in giving the detailed structure of the district and in enab
him to arrive at definite laws regarding ore deposition. The
mate study of the districts, made during the preparation of t
plans and previously, led to Faribault's proposing the ore-shoot
zone hypothesis, to be described later.

In addition to the above plans he has also prepared sections
some important mines such as the Libbey, the Bluenose the W
Lake, and the Dolliver Mountain.

In the Annual Report of the Geological Survey, 1886, Vol.
Part P, appears a report of the gold-bearing rocks of the east
part of the Province. In this Faribault deals in some detail w
the geology of the section. The Summary Reports of subseque
years give much detail of the geology of the country surveyed, a
those published since 1897 contain much information acquired fro
an intimate study of the individual districts.

[1]Journal Min. Soc. N.S., Vol. II, p. 110

In a paper entitled "Gold Measures of Nova Scotia and Deep Mining," read before the Canadian Mining Institute in 1899, and illustrated with maps and sections, he gives in a nutshell the conclusions he has drawn from his many years of painstaking research. In this paper he points out the resemblance between the interstratified veins of Nova Scotia and the Bendigo saddle-reefs, develops his pay-zone theory, and advises the initiation of a policy of deep mining. In a report made in 1903 for the provincial government on the problem of deep mining, he reiterates his belief in the possibility of profitable mining at great depths in Nova Scotia, and gives hints as to the best way in which the government can secure the desired end in lending assistance to the introduction of such a policy.

In addition to the above work Faribault has also constructed block and glass models of gold districts, showing the rock-structure and ore distribution: one of the Goldenville district exhibited at the Paris Exhibition in 1900, and at present in the Museum of the Geological Survey at Ottawa, and another of the same district constructed on plate-glass with the assistance of J. A. Robert, and exhibited at the St. Louis exhibition in 1904. The latter has since been placed in the Canadian mineral exhibit at the Imperial and Colonial Institute, London, England, and a duplicate of it is in the possession of the Mining Society of Nova Scotia at Halifax.

In 1905, T. A. Rickard was employed by the provincial government to report on the gold-fields of the Province. This report was not published, but in a letter accompanying it he pointed out that although there is a resemblance between the deposits of Nova Scotia and Bendigo yet[1] "there are differences so great between the two districts as to destroy the economic value of the structural likeness," and "as far as is known, there is no justifiable expectation of such persistence of good ore in depth within the northern gold-field as that of the Antipodes." He expressed the opinion that "mining operations on a small scale, carried out by working miners, without the investment of large sums of money either in equipment or exploration, but based upon local knowledge and skilful prospecting, are likely to prove remunerative."

In addition to the reports already mentioned, the literature of the subject is replete with reports made by competent geologists,

[1] Can. Min. Journal, Ap. 15, 1909, p. 243.

such as Silliman, Hind, and Campbell, for various minin panies. One of the earliest of these, the report on the T district by B. Silliman, 1864, is a classic, and many are of for their detail and for the insight shown by the writers in character of the ore deposits and the economic conditions.

Much that is very valuable has also been contributed by p cal mining men such as J. E. Hardman, W. H. Prest, Per Brown, H. S. Badger Geo. W. Stuart, A. A. Hayward, and Mason, to the Mining Society of Nova Scotia, the Canadian M Institute, and the Nova Scotian Institute of Science, and to va periodicals. These papers are full of suggestions on mining, mi and metallurgy.

Much is recorded in the annual reports of the Departme Mines for Nova Scotia concerning the extent of the sinking, dr of levels, stoping and cross-cutting in different mines, in additio statistics of production. Many of these reports contain ti suggestions and remarks on the different features of the indu and the reports of such inspectors as H. S. Poole and E. Gilpin, are of importance.

At different times since the discovery of gold several con and interesting reports on the gold-fields have appeared. In 1 Heatherington published his guide to the "Gold Fields of N Scotia," which gives a history of the discovery of gold and of progress of the industry in the different districts. In the sa year appeared How's report to the provincial government on "Mineralogy of Nova Scotia," containing a description of the g logy and the gold deposits, as well as a brief statement of the stat of the industry in each district. The Report of the Department Mines for 1874 contains a pointed inquiry by H. S. Poole into t cause of the decline of gold mining in Nova Scotia, and the sa author contributes to the Report for 1878 a strong argument favour of the theory that the veins are of later age than the rock E. Gilpin, jr., has also contributed much to the literature of th subject. "The Mines and Mineral Lands of Nova Scotia," 188 "Ores of Nova Scotia," 1898, and "Minerals of Nova Scotia," 190 summarize the facts concerning the geology and the quartz vein touch upon the question of alluvial mining, and give an outline o the work done in each district together with its production. Hi "Gold Fields of Nova Scotia" in the Transactions of the North o England Institute of Mining Engineers, Vol. 31, 1882, is a good

treatment of his subject and in the Proceedings of the Royal Society of Canada, Vol. VI, Part IV, p. 83, is to be found a discussion concerning the origin of the gold.

W. H. Prest has contributed to our knowledge of the glacial geology of the district, and R. Daly has treated of the physiography of the Province in its broad aspects. Many other writers have studied various phases of the subject, and written papers of more or less practical or scientific interest.

SUMMARY AND CONCLUSIONS.

GEOLOGY.

The evidence bearing on the main geological features may be briefly summarized as follows:

(1) Rocks belonging to the three great classes are met with in the fields, igneous, sedimentary, and metamorphic, the sedimentary rocks occupying a larger area than the igneous, and the metamorphic occupying only a limited area and found chiefly in contact with the igneous rocks.

(2) The igneous rock, with the exception of a number of narrow basic dykes, consists altogether of granite. This varies much in texture and composition, being in some places a medium-grained muscovite granite and in many places a coarse-grained porphyritic biotite granite with large phenocrysts of feldspar. Within it are found pegmatitic phases, but nothing that might be considered of an extrusive nature has been found.

(3) The sedimentary rocks consist of quartzites and slates. Traverses from south to north across the field reveal the fact that there are several wide zones of slate alternating with wide zones of quartzite carrying beds of interstratified slate. These zones have an easterly and westerly extension parallel to the general strike of the rocks, and are many miles in length and frequently several miles in width. They represent not a succession of formations, but a repetition of two well-defined formations, one a slate and the other predominatingly a quartzite. The beds dip at high angles, a wide stretch dipping to the north being succeeded on the north or south by a wide stretch dipping to the south. Occasionally beds dipping to the south have been traced with a gentle curve, pitching to the east or west, around to a position in which they dip to the north.

This examination of the structure of these rocks shows th
are folded in long east and west anticlines, which at differen
plunge to the east or west and form domes more or less elo
The anticlines are on the average 3 miles apart, and f
to 100 miles long, and the domes on any one anticlin
10 to 25 miles apart. The quartzite or Goldenville
tion is found on the anticlines and domes, and the slate ge
in the synclines; this shows that the former is the lower of th
The slate or Halifax formation is everywhere found to li
formably on the quartzite. Numerous faults cross the serie
northwesterly direction and the horizontal displacement is in
cases over a mile in extent. Very extensive erosion has br
the country to the condition of a peneplain and exposed an im
thickness of these stratified rocks; the quartzite so far as k
attains a thickness of 16,000 feet, and the slate formation k
the synclines is 14,500 feet thick. The age of this series i
known. It has been regarded as of Cambrian age, but man
of the opinion that its history reaches back to still earlier tin

(4) The metamorphic rocks consisting of gneisses, schists,
phyllites are found chiefly in the neighbourhood of the granite,
are produced by the contact action of the granite upon the
ments.

(5) The earliest rocks deposited after the granite intrusion
rocks of the Horton series. These have not suffered the close f
ing to which the gold-bearing series was subjected, and are compo
in places of the decomposed granite of the gold fields. The Hor
series is of late Devonian or early Carboniferous age.

(6) All these rocks have in places been completely denuded
all loose surface material, and frequently they are found with polis
faces bearing long parallel scratches or grooves with a gene
southerly direction. Boulders, many with their angles rounded
are frequently found scattered several miles from their correspon
ing bed-rock, and large hills and long ridges of sand and gravel a
numerous. The evidence seems quite conclusive that the area w
within recent times subject to glacial erosion.

The gold-bearing series is thus seen to consist of two gre
conformable formations of sedimentary rocks, closely folded in
long anticlines, plunging at intervals and forming domes. The
were intruded by, or subjected to the action of great subjacent bodi
of granite which altered portions of the sedimentaries to gneiss

and schists. The main folding of the sedimentaries and the intrusion of the granite took place before the close of the Devonian period when the Horton series was laid down. Sub-aerial erosion removed a great proportion of the slate formation and much of the quartzite, and revealed wide stretches of the latter along the anticlines, and in recent times the loose surface deposits were rearranged by glacial action.

Ore Deposits.

As regards the ore deposits we know:—

(1) The gold occurs chiefly in quartz veins, some of which cross the strike of the formation, but most of which are interstratified with the rocks and lie chiefly in the slate beds found in the quartzite formation.

(2) The veins are found on the domes or at the plunging of the anticlines, and the outcrops form a series of concentric ellipses or portions of ellipses. Some veins have been traced around the arch of the dome from one limb to the other, and sinking has revealed the presence of a series of saddle-veins which do not come to the surface.

(3) While the most of the veins are interstratified they are sometimes seen to cross the slate bed and pass from the foot-wall of quartzite to the hanging-wall. Inclusions of slate in the vein are common, and veins composed of layers of quartz and interlaminated films of slate are exceedingly common. Veins are frequently corrugated, the corrugations on the sides of the dome being parallel to the strike, while those towards the ends pitch away from the centre of the dome at an angle between the dip and strike of the strata. These latter corrugations are often quite large and are called barrels.

(4) Small veins called angulars pass out from the main veins through fractured strata and frequently pass upward and from one vein to another.

(5) The gold occurs in shoots which pitch at a low angle to the east or west. Most of the gold is free-milling, but sulphides commonly found in the veins carry an important amount which is not amenable to amalgamation.

(6) The richest portions of the veins seem to lie in those parts of the domes where there is some irregularity in the rock structure, where a greater fracturing of the strata or a greater opening be-

tween the strata is produced. This frequently occurs alon subordinate flexure in the fold, or along lines radiating fr centres of the domes at small angles, with their major axes

It is evident that the deposition of the ore is depend the rock structure. It is believed that during the folding pr there was a slipping of the beds one upon another with a quent fissuring along the bedding planes of the less resistant the slates. During the opening of these fissures deposition of ferous quartz took place, and this occurred in those parts the fracturing of the rock was sufficient for the p ing of the tions. The problem of the origin of the solutions has not satisfactorily solved. Two theories have been advanced, one the veins were filled by the lateral secretion of auriferous solu and the other that the minerals were deposited from ascending mal solutions. The latter is the more generally accepted th

Gold has been mined in some fifty different centres, but, the geological structure has been so well mapped and the anticl traced, systematic prospecting along these folds by men who un stand the intimate relations that exist between rock structure gold deposits may yet reveal the presence of other paying centre

Future Possibilities.

There is reason to believe that the auriferous veins have been exhausted.

(1) The most of the mining done in the early days of the dustry was carried on by individuals who had not sufficient capi to do more than merely test the surface of the vein. Even wh capital was available the prevailing notion that the deposits we only superficial prevented the testing of the veins at any conside able depth, and thus only the upper pay-shoots were worked ou Later operations have shown that many mines that were abandon in the early days contain much rich ore. There are still man abandoned veins, the surface of which was at one time worked wit profit, and which would probably yield good returns if reopene and worked with the economical methods of to-day.

(2) The veins that have been worked with profit lie in a belt approximately parallel to the axis of the main anticline or along some subordinate flexure, that is their position on the fold is de- pendent on some particular feature of the rock structure. As this particular feature would be repeated in underlying strata in a zone

parallel to the axial plane of the anticline, it has been conceived that there is in each district a pay-zone, which has a surface equal to the area in which the paying veins outcrop, and which extends to an indefinite depth parallel to the axial plane. With this idea in view a policy of deep mining has been recommended. In support of this theory stand the two facts.

(*a*) The veins of Nova Scotia resemble the saddle reefs of Bendigo, Australia, which have been mined at a great depth. (*b*) Veins which do not outcrop have been found by sinking and cross-cutting and have proved profitable.

On the other hand it must be stated that the theory concerns itself only with the relations existing between rock structure and ore deposits, neglecting the problem of ore deposition and of secondary concentration by superficial agencies.

GENERAL CHARACTER OF THE DISTRICT.

TOPOGRAPHY.

General Account.

Regional.—As regards topographical structure, the general trend of the ridges, their low elevation, and the lowland valleys, Nova Scotia forms a part of the great topographical unit which stretches from the state of Georgia to the Gulf of St. Lawrence. The ridges, which have a northeast and southwest direction, are the wasted remnants of rugged mountains, which through the long continued processes of erosion have been reduced to a stage of maturity or old age. The [illegible]nt a low even sky-line, rarely broken by monadnocks, that [illegible]eater resistance to the forces of erosion.

In the ea[illegible] part of the continent there are three zones of elevation. The lowest, not greatly exceeding 100 feet in height, is found chiefly along the coast from Maryland southward, where it is known as the Coastal Plain. It is found in narrow bands farther north, and in Nova Scotia in the valley between the North and South mountains, and at the head of Chignecto bay, and some other places along the coast. The second zone, ranging in height from 100 to 1,000 feet, lies to the west of the first. In the southern part it is known a[illegible] Piedmont plateau and varies from 600 to 1,000 feet in height. In the north it generally extends to the sea without the intervening coastal plain, and the greater portion of Nova Scotia consists of such a plateau of low elevation. The

Cobequid mountains form the highest ridge and these are fro to 1,000 feet high. The third zone, consisting of the Appal system, is to the west of the second and varies from 1,000 to feet in height; but some monadnocks rise to over 6,000 feet This zone does not stretch into the mainland of Nova Scotia.

The general slope of the whole area is to the east, and, alt the rivers frequently flow for some distance in a northeast or s west direction between the ridges of higher elevation, they event break across these and empty into the Atlantic. Water-gaps wind-gaps in the higher ridges are common. The rivers cro the plateaus have numerous rapids, cascades, and water-falls, cut gorges, and thus bear marked evidence of youth, although levelling of the hills and the advanced erosion give the topogr the appearance of age.

Local.—The gold-bearing area of Nova Scotia may be rega as a low-lying plateau with a southeasterly slope towards the At tic and with a general elevation seldom over 500 feet. In the w the long escarpment of the South mountain forms the northern e of this plateau, in the east a decided ridge extends along the north boundary from Cape Canso to Musquodoboit river while a break made in the general slope by the swinging of the divide near centre of the Province southward to within a few miles of Halif The whole surface is composed of gently undulating hills, and rar is the even sky-line broken by conspicuous individual elevatio In contrast with the rounded much denuded undulations stand t deeply incised river valleys, through which torrents dash over rapi and cascades with all the appearance of youth. [1] "Thus the plate is to be regarded as a single great topographical facet above whic rise local cameo-like reliefs in the form of a few residual hills. also presents the appearance of having been carved in intagli Sunk beneath the facet are many deep, narrow, and steep-side valleys in the north, typified by the gorges of Bear river, Gaspereau river, the upper Shubenacadie, and the East river; in the south the bed-rock valleys are shallower and have been in large part filled by drift, with the result of obscuring their pre-glacial form."

A study of the structure of the gold-bearing rocks reveals the fact that they have been subjected to extensive erosion and that all

[1] Daly, R. A. The Physiography of Acadia. Bulletin of the Museum of Comparative Zoology at Harvard College. Vol. XXXVIII. Geol. Series, Vol. V, No. 3, p. 77.

se are from 800
he Appalachian
1,000 to 5,000
5,000 feet high.
Scotia.
and, although
heast or south-
hey eventually
Vater-gaps and
ivers crossing
ter-falls, have
although the
e topography

be regarded
ls the Atlan-
In the west
orthern edge
the northern
e a break is
de near the
of Halifax.
and rarely
elevations.
s stand the
over rapids
the plateau
bove which
l hills. It
intaglio.
steep-sided
Gaspereau
south the
t filled by

eveals the
l that all

Museum
ol. Series.

Plate II.

Valley of St. Mary river.

9869 p. 24

that is left is the upturned edges of the closely folded beds, and the low granitic masses that intruded them. All that remains of what was probably a highly elevated mountain system is a plateau reduced nearly to sea-level.

Detailed Account.

Relief.—As has been pointed out, the general slope of the southern plateau is to the southeast, but, although there are no prominent ridges and conspicuous single elevations are rare, there has been enough differential weathering to give to the whole plateau an undulating character. The granite has offered greater resistance to the weathering than the sediments and thus the granite batholiths form somewhat more prominent features of the topography than the surrounding sediments. The two highest points in the gold-fields are in rock of this kind: one is 2 miles west of McGee lake, south of Kentville, and the other is Armstrong hill, a short distance west of Windsor-Chester road, each having an altitude of 800 feet. Other elevations determined are: on South mountain at Canaan, south of Kentville, slate, 755 feet; on South mountain south of Wolfville, and one mile east of Newtonville, slate, 750 feet; Mount Ardoise, slate, 738 feet; on Windsor-Chester road, near Carding lake, granite, 728 feet; Broom hill, one mile west of New Ross, granite, 715 feet. The slope is towards the south, but elevations of 300 or 400 feet within a short distance of the Atlantic coast are common and many points exceed 400 feet.

Differential weathering has manifested itself to a certain extent in the sediments. Valleys have been worn in the less resistant slate in the synclines, while the quartzite of the anticlines forms ridges which have a general northeast trend.

The slope of the plateau determines the direction of the drainage valleys, which are roughly parallel and have a course a little east of south.

This topography was modified by the recent glaciation to which the area was subjected. There is abundant evidence of glacial action in the scratches and grooves, travelled boulders, moraines, and kames. That there was one general southerly ice movement is shown by the numerous boulders of amygdaloidal trap, syenitic gneiss, syenite, hornblende granite, and diorite found along the Atlantic coast. The source of these boulders is to be found in the trap of the North mountain and the igneous rocks of the Cobe-

quid mountain. The general movement was from north to but in addition to this there was much glaciation of a local as is shown by the direction of the scratches on the bed-roc by the distribution of angular boulders. For example a local erly movement over South mountain is evidenced by inn able boulders of granite scattered over the whin and slate t north of the great granite mass, and even over the North moun

An examination of the table of glacial striæ shows tha general movement of the ice was a little east of south, but th the western end of the Province there was a movement toward southwest. It is also seen that in different localities there was siderable variation from this general direction, owing, no do to the influence of local topography. The facts seem best expla by supposing that there was a general southerly movement of ice the whole peninsula, that probably the St. John Valley glacier tinued across the Bay of Fundy and the peninsula of Nova Sc just as the Northumberland glacier crossed the Northumberl strait and overran all, or a part, of Prince Edward Island,[2] and t during the final epochs of the ice age the glaciation assumed a lo character, the direction of movement being affected to a gr extent by local topography. This local ice movement would m or less obliterate the striæ formed by the earlier general moveme Striæ, such as those about Gore mountain, would be formed ru ning in other directions than south, and boulders would be carri in various directions and deposited in unexpected places, such the granite on North mountain.

Some little detailed study of the drift has been made, and o investigator thinks that a close examination of some deposits the western part of the Province points to at least three glaci epochs of erosion and deposition with interglacial epochs of oxida tion and sub-aerial erosion.[3]

The most marked effect of the glaciation is the extensive denu dation of the gold-bearing rocks; great stretches of rock are lai bare and over the greater part of the area the soil is thin, covere with boulders, and lacking in fertility. Granite and whin, being more resistant than slate to the weathering agencies, opposed some- what more prominent barriers to the onward movement of the ice,

[1] Ann. Rep. Geol. Survey, Can., Vol. VII, Part M, p. 96.
[2] Ann. Rep. Geol. Survey, Can., Vol. VII, pp. 90-93 M.
[3] W. H. Prest 'Glacial Succession in Central Lunenburg' Trans. of the Nova Scotian Inst. of Science, Vol. IX, p. 158.

and thus were more completely denuded, and worn and polished into rounded hills and roches moutonnées. So completely has the soil been removed from the granite hills that some areas are almost devoid of vegetation, and others have barely enough to support a forest growth.

"In addition to ordinary striations, evidences of furrowing and ploughing are also met with, and in some instances to a depth which is very remarkable. Thus, at the extremity of the island on which Lockeport is situated, alternating beds of quartzite and slate, dipping steeply to the sea, are ploughed along their edges into canoe-like troughs, thirty or forty feet long, three or four feet wide and as many deep; while on a small island near Port La Tour, similar beds have been gouged by a like agency to a depth varying from ten to twenty feet."

Although numerous worn boulders of trap from the North mountain and of gneiss, granite, and diorite from Cobequid mountain are found in the glacial till along the Atlantic coast, the large proportion of the boulders possesses a decidedly local character. Here and there blocks of granite are found that have travelled a few miles, but the fragments generally belong to the formation over which they lie; belts of whin are overlain by whin boulders, belts of slate by slate debris, and granite areas by granite boulders. So generally is this the case, that, where the contacts between different rocks are concealed by drift, geologists have often based their determination of the boundary on the distribution of the angular boulders. The rock fragments vary considerably in size, those that have travelled the farthest being usually the smallest and most worn. One of the largest seen by Bailey in the southwestern part of the Province was found 7 miles from the town of Liverpool on the banks of Liverpool river, and was estimated to be 30 feet long, 20 feet wide, and 20 feet high. These boulders are often piled together in rough heaps, or very unevenly distributed over the ground, some areas being swept clean while others are literally covered. Boulders are, of course, most abundant in the vicinity of the granite and whin, and lie chiefly in the bottom or on the sides of the valleys while the tops of the ridges are tolerably free.

Glacial deposition is more marked along the Atlantic coast west of Halifax than in any other part of the area, and in many parts morainic development is a very conspicuous feature, giving the topography a beautiful undulating character as seen in the vicinity of

Chester. The drift lies in hills some of which have a nort south extension, while others run east and west.[1] "Of ordinar minal moraines, the interior of Queens, Shelburne, and Yar counties affords many examples, and to their presence and infl many features in the drainage of the country are no doubt due headwaters of the Port Medway, Liverpool, Jordan, and other r may be cited in illustration."

"In addition to moraines, the peculiar accumulations know kames or 'Horse-back,' are abundant in southwestern Nova Sc and are, in some instances, of remarkable character." A r probably of this nature, crosses the Liverpool and Annapolis ro the Maitland settlement, extends eastward across the Maitland to Gull lake, and then turns northerly by Gull Lake stream to south of Perrot settlement, while in the opposite direction it tends westward by way of Long lake to Frozen ocean, finally e ing into Digby county. This kame seems to have derived its ma ial, chiefly blue slate, from the south rather than the no "Kames" are found also in Shelburne county. They are seve miles long, "somewhat tortuous in their course, but with a gen southerly trend, are from 20 to 40 feet high, and are usually j broad enough at top to afford room for a roadway." The m remarkable of these ridges is the so-called "Boars back" of Dig county, which is 20 miles long. "As usual this kame consists sand and gravel, with some embedded boulders, and also, as usu it is bordered on either side by extensive low and flat tracts." The glacial deposits are often short and spindle-shaped and arranged in series parallel and overlapping lines, and in some cases they bifu cate. [2]Sometimes they include a number of round, deep depressio or "kettles," as on the road from Shelburne to Lake John, east Jordan river.

[3]A conspicuous feature of the landscape at the head of Po Mouton harbour, Queens county, and along portions of the shore Barrington bay, Shelburne county, is the series of sand dune that appear at a distance like great drifts of snow. They concea for the most part the underlying rocks. The sand is pure an white, and is so incoherent as to be readily blown about by th

[1] Bailey, L. W. Some Nova Scotia illustrations of Dynamical Geology Trans. of the N. S. Inst. of Science, Vol. IX, p. 180.
[2] Bailey, L. W. Ann. Rep. Geol. Survey, Can., Vol. IX, Part M, p. 13.
[3] Bailey, L. W. Trans. of the Nova Scotian Inst. of Science, Vol. IX, p. 180.

wind. The dunes on Barrington bay cover 15 or 20 acres, and reach their highest elevation, 40 feet, near their inner edge. The hills are slowly travelling inland and burying the vegetation in their path.

The Atlantic coast is characterized by almost innumerable indentations alternating with long narrow tongues of land. These indentations are from 2 to 7 miles long and from one-half to 3 or 4 miles broad, and on account of these the coast line is almost quadrupled as compared with the shortest distance between points. This is well illustrated by the shore-line of Queens and Shelburne which is over 240 miles, while a straight line parallel to the general trend of the coast is only 65 miles. The sides of these inlets are approximately parallel, but some of them open out into bay-like forms, the entrance to which is divided by islands into two or more channels. Their general direction is from south to southeast, corresponding to the general slope of the land surface, the direction of the river valleys, and the direction of glacier movement. They are in fact fiords and are tongues of water, which on the subsidence of this coast entered the lower ends of the river valleys or the depressions lying between glacial deposits.

[2] Sir Charles Lyell at the time of his visit to America, in 1841, noted their true character and remarked on their resemblance to the fiords of Norway. Many of the islands are rock-bound, but towards the southwest great numbers of them are composed wholly of glacial drift as at Mahone bay. At the west end of the Province the coast is more regular, and from Port Maitland to Meteghan, it rises in places in precipitous bluffs nearly 200 feet high. Here the slates are highly inclined and present their edges to the sea, which has worn them into fantastic shapes; chimneys are left standing detached from the mainland, and numerous caves have been worn out by the dashing of the waves. [3] The numerous indentations of the southern coast afford many excellent harbours, the best of which, such as Whitehorse, Country Harbour, Liscomb, and Halifax, are never obstructed by drift ice.

There is abundant evidence of a Post-Glacial subsidence of the Atlantic coast, in the way of drowned river valleys, and swamps and peat deposits lying at the level of low tide. At Musquodoboit

[1] Bailey, L. W. 'Notes on the Surface, Geol. of Nova Scotia,' Trans. N.S. Inst. Sc., VIII, p. 1.

[2] Bailey, L. E. Ann. Rep. Geol. Survey, Can., Vol. IX. Part M.

[3] Faribault, E. R. Ann. Rep. Geol. Survey, Can., Vol. II. Part P

harbour, on a very calm day the sharply incised channel of M doboit rive can be traced for some distance into the h [1]Prest mentions several swamps and peat beds now lying tide, a level at which it would be impossible for them to Below Black point, at the mouth of Liverpool river, Queens a deposit of black mud nearly a foot thick, containing r bushes, has been washed away in places by the waves, dis angular fragments of rock which show no appearance of ever formed part of a sea beach. At Black Rocks, on the southeas of Lunenburg county, there is a deposit of peat and mud, cont stumps and roots of trees, which owing to their position co no way be accounted for by a land-slide. This deposit, lying valley at the head of a cove, is several feet deep, and its surf washed daily by the tides. At the mouth of Broad river, Q county, is a large depression, which at low tide is a marsh co ing a pond a quarter of a mile long, but at high tide is a lake. partly decayed stumps and roots of trees found here attest t veracity of the old settlers, who say that seventy-five years ag was a swamp covered with a forest. At Port Mouton and at places along the coast peat deposits containing logs, stumps, and are seen at low tide. H. S. Poole, in a contribution on "Fea of the Continental Shelf of Nova Scotia," points to a probabili a recent subsidence. This continental shelf extends about 100 from the present shore, where from a depth of eighty fathom rapidly descends to 1,000 fathoms or more. Among the ma feature of this shelf is "a large inland sea or lake with an o to the south. Then there are prominent extensions of existing montories and headlines, islands large and small, plateaux crow by knolls and bearing small lakes, a broad valley with a cha drained at that depth, broad estuaries to the main drainage sys and, perhaps, some rocky peaks, river channels with sloping ba and islets, or with sides precipitous in places. Besides these, even perhaps of more interest than all other features, are many d isolated depressions often close to knolls of elevation above average of the neighbourhood." These features cannot be explai as the result of the action of ocean currents, or deposition floating ice, and the only satisfactory conclusion is that this co

[1] Prest, W. H. 'Evidence of the Post-Glacial Extension of the Sout ern Coast of Nova Scotia.' Trans. N.S. Inst. Sc., Vol. VIII, p. 143.
[2] Trans. Royal Soc. Can., Second Series, Vol. XII, Section IV, p. 7

tinental shelf was subject to the same contouring agencies as was the portion now above the sea-level, and has not been exposed long enough to submarine deposition to be reduced to the monotonous level of ordinary sub-oceanic topography. The movement of the strata along the bedding planes observed in some parts of the gold-fields indicates a relief of the pressure that produced the folding. That this in some cases has taken place in Post-Glacial times is shown by the fact that some beds of quartzite, which had their edges planed smooth by glacial action, have subsequently slipped upon each other sufficiently to produce a step-like arrangement, the height of the steps averaging about an inch. The evidence seems quite convincing that in this part of the Province subsidence has been recent, and is probably in progress at the present day.

Drainage.—Factors determining the present drainage system are: the Pre-Glacial valleys, which had a southeasterly direction; valleys having a northeast trend, probably Pre-Glacial and due to differential weathering of the sediments; glacial erosion and deposition. The larger rivers are approximately parallel, and follow the general slope to the southeast. In the course of their descent they frequently expand into considerable lakes or receive the overflow from lake expansions lying in the transverse valleys. Some have portions of their course determined by the great cross-country faults, such as West River Sheet Harbour, and Country Harbour. The most important rivers in the western part of the Province are the Lahave, Port Medway, Liverpool, Jordan, Roseway, Clyde, and Tusket, while in the eastern part are the Musquodoboit, Sheet Harbour, Liscomb, St. Mary, and Country Harbour. Some of these, like the Musquodoboit and St. Mary, have their source in the later rocks to the north and the directions of their upper courses are controlled by the slope of those areas, but on coming to the rocks of the gold-fields they take a straight course across the formation to the sea. The Gaspereau of Kings county, a river of great possibilities for the development of power, follows a deep gorge it has cut along a syncline in the slates. Many other rivers such as the Liscomb, Sheet Harbour, Musquodoboit, the Northeast, and Indian rivers of St. Margaret bay, the Gold, Port Medway, and Liverpool could be utilized for power. In addition to these larger streams there are a great many smaller ones with fall enough to give over 100 horse-power. A part of the power on many of the rivers is being utilized, but there are few that are not capable of further

development, for example[1], in the last 16 miles of the Liverpoo
there is a total fall of 260 feet, but of this only about 100 fe
now developed. On account of the small size of the Provin
drainage basin of each river is small, the run off is rapid, and
factors coupled with the decreased precipitation of the su
months prevent a steady supply of water in spite of the fac
the area is covered with forests and so retains the moisture l
than deforested areas; thus power plants cannot be run to
full capacity the year around. To overcome this difficulty atte
is being directed to the possibility of creating large storage b
by means of dams, or to the advisability of putting in[2] aux
steam or gas plants. The 5,927 horse-power developed on the L
pool river can be obtained during only nine months of the year
it is estimated that, were full storage properly developed and d
buted, instead of the 5,927 horse-power there could be developed
the same fall 7,000 horse-power continuously, and 8,000 horse-p
in that part of the river not utilized at present.

The lakes of the Province are numerous, small, and gene
shallow, and dotted with islands, many of which are mere pile
stones. Some are due to the widening of the Pre-Glacial val
while others had their origin in the recent glaciation. Altho
glaciation had no very marked effect on the general drainage,
in the more minute details it produced great changes by scoop
out alluvium-filled hollows and blocking up Pre-Glacial valleys. T
catchment basins were formed resulting in numerous small la
Many lakes could be easily dammed and made into reservoirs
the retention of water for power purposes.

Along the courses of many streams are low-lying areas cove
by water during a portion of the year, but dry in the summer a
producing a good growth of grass.

Conditions have been favourable to the formation of peat b
in Queens, Halifax, and Guysborough counties, and they are espe
ally abundant in Guysborough.

CLIMATE.

Nova Scotia lies roughly between latitudes 43° and 46°, a
consequently has a temperate climate, one well suited to the vigo
ous pursuit of the mining industry the year around. In additio

[1] Yorston, C. E. Trans. Nova Scotian Inst. Sc., Vol. XI, Part 4, p. 65
[2] Doane, F. W. Trans. Nova Scotian Inst. Sc., Vol. XII, Part I, p. 2

Lake Thomas, Waverley.

to being in the temperate zone, it is nearly surrounded by the sea, which has a moderating influence and lessens the tendency to extremes of heat and cold, to be found in inland districts in the same latitudes. The heat of summer is not excessive, and the cold of winter is tempered by the proximity of the sea. The seasons are somewhat later than those of inland districts on account of the cold currents and floating ice from the north. Precipitation is moderate, but in excess of that of the inland provinces of Canada. The mean maximum temperature of Halifax from 1873 to 1887 was 53·56°, the mean minimum 34·49°, the absolute highest 93°, and the absolute lowest—17°; and the mean precipitation from 1898 to 1907 inclusive [illegible] 6·60 inches. The number of days on which precipitation w[illegible] in 1907 was 190, and a trace on 15 days. The occasional [illegible]g of those enterprises dependent on water-power must not be considered as due to slight precipitation, but rather to the small area of the river basins and the rapid run off.

The following table of precipitation was taken from the Annual Report of the City Engineer of the City of Halifax, N.S., for 1907-8.

PRECIPITATION AT HALIFAX, N.S.

Table showing the monthly and annual depth of rain and melted snow, expressed in inches; also the amount that has fallen from January 1 to the end of each month, inclusive, during each year.

Year.	January.	February.	January to February inclusive.	March.	January to March, inclusive.	April.	January to April, inclusive.	May.	January to May, inclusive.	June.	January to June, inclusive.
1898	4·060	4·422	8·482	4·068	12·550	7·346	19·896	2·366	22·262	5·598	27·860
1899	5·083	3·613	8·696	7·178	15·874	3·278	19·152	3·677	22·829	3·875	26·704
1900	8·532	5·277	13·809	6·577	20·386	3·949	24·335	4·254	28·589	2·658	31·245
1901	6·043	0·966	7·009	4·102	11·111	6·318	17·429	5·556	22·985	6·959	29·944
1902	3·289	2·735	6·024	7·757	13·781	3·067	16·848	3·725	20·573	4·908	25·481
1903	5·082	3·712	8·794	7·294	16·088	5·515	21·603	0·676	22·279	3·493	25·772
1904	6·318	5·328	11·646	5·590	17·236	5·912	23·148	3·315	26·463	2·668	29·131
1905	8·290	5·326	13·616	2·804	16·420	1·260	17·680	3·217	20·897	4·970	25·867
1906	4·624	5·208	9·832	7·142	16·974	8·381	25·355	6·208	31·563	1·704	33·267
1907	6·186	4·481	10·667	3·364	14·031	3·218	17·249	3·344	20·593	3·723	24·316

Year.	July.	January to July, inclusive.	August.	January to August, inclusive.	September.	January to September, inclusive.	October.	January to October, inclusive.	November.	January to November, inclusive.	December.	Total for the year.
1898	3·652	31·512	5·651	37·163	4·158	41·321	4·845	46·166	10·248	56·414	4·066	60·480
1899	5·747	32·451	1·542	33·993	3·201	37·194	6·191	43·385	4·590	47·975	5·038	53·013
1900	1·872	33·117	3·993	37·110	5·043	42·153	7·365	49·518	6·858	56·376	3·321	59·697
1901	1·585	31·529	3·656	35·185	6·872	42·057	4·906	46·963	2·560	49·523	8·573	58·096
1902	1·651	27·132	4·767	31·899	4·657	36·556	4·252	40·808	3·813	44·621	7·295	51·916
1903	4·313	30·085	4·247	34·332	4·237	38·569	6·368	44·937	9·598	54·535	4·590	59·125
1904	2·323	31·454	6·511	37·965	4·502	42·467	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1905	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The following table of temperatures and mean precipitation was compiled by the Director of the Meteorological Service, Toronto, Ont., the years of observations being as follows:—

Yarmouth:—

Temperature	Mean maximum	1895 to 1902
	Mean minimum	1895 to 1902
	Mean	1895 to 1902
	Absolute highest	1880 to 1902
	Absolute lowest	1880 to 1902
Precipitation	Mean precipitation	1880 to 1907

Halifax:—

Temperature	Mean maximum	1873 to 1887
	Mean minimum	1873 to 1887
	Mean	1873 to 1887
	Absolute highest	1868 to 1902
	Absolute lowest	1868 to 1902

Sydney:—

Temperature	Mean maximum	1874 to 1904
	Mean minimum	1895 to 1904
	Mean	1895 to 1904
	Absolute highest	1870 to 1904
	Absolute lowest	1870 to 1904
Precipitation	Mean precipitation	1874 to 1904

Maximum, Minimum, Absolute Highest, Absolute Lowest, and Mean Temperature. Also Mean Precipitation: At Stations along the Atlantic Coast of Nova Scotia.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
YARMOUTH													
Temperature.													
Mean maximum	34·0	32·4	39·1	48·1	55·8	63·0	68·4	68·6	63·6	56·1	47·2	37·9	51·18
Mean minimum	19·6	20·6	27·6	33·6	40·5	48·0	53·3	54·3	49·0	42·0	34·0	24·6	37·26
Absolute highest	54	52	56	72	74	81	84	83	79	73	66	56	84
Absolute lowest	7	12	2	14	25	30	41	40	32	26	11	-3	-12
Mean	26·8	26·5	33·3	40·8	48·1	55·5	60·8	61·4	56·3	49·0	40·6	31·2	44·19
Mean precipitation	5·22	4·28	5·04	3·62	3·80	2·93	3·75	5·72	3·58	4·46	4·49	5·05	51·94
HALIFAX.													
Temperature.													
Mean maximum	30·9	31·6	36·5	46·6	58·4	68·2	73·9	74·3	67·6	56·2	44·2	34·3	53·56
Mean minimum	13·1	13·9	20·8	29·9	38·9	47·0	54·4	55·4	48·8	39·8	32·2	19·7	34·49
Absolute highest	55	50	55	76	88	93	93	93	85	80	65	55	93
Absolute lowest	16	17	9	7	24	33	41	42	32	23	4	-11	17
Mean	22·0	22·7	28·6	38·2	48·6	57·6	69·1	64·8	58·2	48·0	38·2	27·0	43·58
SYDNEY, C. B.													
Temperature.													
Mean maximum	20·6	29·6	36·7	45·4	56·3	64·9	72·4	71·8	66·1	55·7	45·8	35·2	50·04
Mean minimum	14·9	13·6	20·8	29·5	36·8	44·7	54·1	53·9	47·7	39·7	32·4	22·6	34·22
Absolute highest	58	53	57	77	84	91	89	90	87	77	67	[illegible]	[illegible]
Absolute lowest	25	-24	-24	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AGRICULTURE.

The area underlain by the gold-bearing rock may be considered as quite unfit for agriculture, although there are a few regions of small extent where the deposit of glacial detritus has been deep enough and of fine enough texture to admit of cultivation. As has been pointed out, the granite and whin areas have had a great deal of the soil removed and are thickly covered with boulders. Although the soil is deeper over the slate areas on account of the greater readiness with which the rock weathers, still even these are often so covered by boulders as to make them unsuitable for agriculture.

The greater proportion of the inhabitants along the southern coast are fishermen. Many of these spend the intervals between fishing in tilling small patches of ground for potatoes, vegetables, and fruits for their own use.

East of Halifax little farming is done in the gold-bearing areas proper, but some good stretches of arable land occur along the valleys of St. Mary and Stewiacke rivers immediately to the north, and along the upper courses of the Musquodoboit, which follows the lower Carboniferous sediments overlying a small portion of the gold-bearing area.

In the western part of the Province farming is carried on to a limited extent in some places. The glacial deposits are deeper than in the east and have provided some arable land to the west and northwest of Mahone bay. This is the best apple-producing district of Nova Scotia, outside of the famous Annapolis-Cornwallis valley. Other fruits such as pears and cherries are also produced. The valley of the Lahave presents some agricultural land, and in its upper stretches, at New Germany, in the north of Lunenburg, is a rich belt extending some distance east and west.[1] About the headwaters of the Medway, at Brookfield and Caledonia, in Queens county, is some good land, and apples an other fruits are successfully cultivated. In some parts of Yarmouth and Digby the glacial deposits are of such a nature as to permit of cultivation, and on the south shore of Annapolis basin there is considerable gardening and fruit-growing. The chief grain crop of the area described consists of oats; a small amount of barley and buckwheat is grown.

[1] R. R. McLeod. Markland or Nova Scotia, p. 381.

Potatoes, turnips, and other vegetables are important. I
so far as the gold-bearing area is concerned agriculture car
be said to be one of the industries.

FAUNA AND FLORA.

No attempt will be made to give a list of the fauna ar
of the Province, suffice it to say they are such as are co
found in the temperate climate of North America.

The fish of the sea form the basis of the most important i
of the Atlantic coast, while the trout and salmon of the strea
the wild game of the forest furnish sport for the leisure
The taking and canning of the lobster gives employment to
many. Of the fish that abound along the shore the most imp
are cod, haddock, mackerel, herring, hake, pollock, halibut, s
alewives, smelts, and eels. Salmon and trout are found in
of the rivers flowing through the gold-bearing series.

The wide stretches of forest land form natural preserv
wild game. For the lover of big game moose are abundant, ar
protected by government regulations. The number reported
in the Province in 1908 was 769, and of these the greater p
were got in the region under study. Caribou and red dee
rare, but a few bears, wild-cats, foxes, hares, rabbits, otters
mink are taken. The beaver is probably extinct, although
beaver-dams are numerous, showing that the animals were con
at one time, and during a portion of the eighteenth century
value of various articles of commerce was expressed in their eq
lent of beaver skins.

Black-ducks, wood-ducks, woodcock, and partridge furnish s
for the huntsman. Water birds are of great variety and nun
Among the common land birds are robins, thrushes, catbirds, vi
warblers, sparrows, swallows, woodpeckers, flycatchers, blackb
owls, hawks, crows, and jays. For details regarding the fauna
reader is referred to numerous papers in the Transactions of
Nova Scotian Institute of Science.

The greater part of the area under study is forest land.
soil being unsuitable for agriculture, there was not in the early d
that wanton destruction of valuable timber which in other la
the pioneer found necessary in order to prepare the soil for culti
tion. But with the increase in the value of timber, the lumberi

industry has assumed large proportions, and unless some broad policy is adopted for the preservation of present resources and for reforesting, this great source of wealth will soon be exhausted. The pine has to a great extent disappeared through the reckless use of the axe and devastation by fires, and the spruce, the hemlock, and the tamarack are becoming the important trees for lumber. The hemlock furnishes supplies of tan-bark in addition to lumber, and the spruce, one of the most valuable of the forest trees, is used extensively for building, ship-building, mine-timbering, and the manufacture of lumber, shingles, staves, and woodpulp. Beech, maple, birch, hemlock, balsam, ash, and oak provide mine-timber and fuel for those within reasonable access, and large tracts of these woods await means of transportation to make them available. Large areas that have been swept by fire have grown up with scrub spruce, poplar, alder, and white birch, in some places so dense as to be almost impassable.

Of the timber lands of the Province bearing merchantable timber, it is estimated that 5,000,000 acres are owned by lumber and pulp companies, 2,000,000 acres by farmers, and 750,000 acres leased to companies. It is also estimated that there are 1,500,000 acres of young forest and of land capable of afforestation.

Preliminary to carrying out a policy whereby the timber resources of the Province will be better conserved, a forest survey is being made by D. Fernow, Dean of the Faculty of Forestry, Toronto University. A map is being prepared showing the location, extent, and character of the different forested areas. A survey of eight counties was made in the summer of 1909. The forest area was classified under three types: pure conifer growth, pure hardwood growth, and mixed growth. These were again subdivided according to the degree to which they had been culled. The barrens were also classified, and a great deal of other valuable information collected to show the extent of the Province's resources in forest growth and possibilities.

Wild edible fruits, such as the blueberry, strawberry, raspberry, blackberry, cranberry, and foxberry grow in profusion, and are of excellent quality.

Nuts are rare with the exception of hazelnuts and beachnuts, which are gathered for home use.

Details regarding the flora of the Province are to be found in papers contributed to the Nova Scotian Institute of Science.

TRANSPORTATION AND COMMUNICATION.

The gold districts may be said to possess excellent facil transportation and communication. No portion of the r far removed from the Atlantic coast, which is deeply ind very numerous deep harbours, many of which are free from year around, so that transportation between different parts Province and with the outside world can be carried out cheapest manner possible. The importation of mining and machinery and supplies, fuel, and provisions is easily effected

Many of the destricts are provided with good railway co cation by the Intercolonial, Dominion Atlantic, and Halif Southwestern railways, and the Caledonia branch of the la railway for the eastern part of the area has been projected.

The most of the districts have good wagon roads con them with harbours and railway stations. Difficulty of acce led to the slow development of some districts in the past, and like Fifteenmile stream, are still suffering under the same cap. The provincial government has pursued a liberal pol the matter of construction and improvement of roads, openin routes into districts that were reported by government officials mising, and assisting in the improvement of old roads to di where mining companies had confidence enough in their und ing to expend money for the same purpose.

Telephone service is general, and probably no mining di of any importance is without such means of communication.

Postal service is quite satisfactory, many districts havi daily mail, and others, regular mail two or three times a wee

COMMERCIAL POSSIBILITIES

Although Nova Scotia is an old Province, it i generally beli that it has not yet attained its commercial possibilities, or acqu that status in which the drain on its resources is balanced by natural processes of reproduction and growth, or powers of recov In some industries, as for example lumbering, the carelessness recklessness of the present operator result in extreme wastefu and sacrifice of future possibilities, while in others, such as utilization of water powers, man has not begun to make the dema that nature is capable of supplying. The possibility of the exha

tion in the near future of the forest reserves is turning the attention of the people seriously to the problem of the conservation of their natural resources, and to the best means by which, through the application of scientific principles to cutting, preventing of fire, and reforesting, a nice adjustment can be effected between output and natural production. The question of the revival of certain fisheries which have become nearly exhausted, for example the shad fishery, has recently received careful consideration, and the introduction of better methods of curing and packing fish will raise the industry to a better condition. The development of the water-power now going to waste should lend an impetus to the manufacturing industry. The mining population have not lost faith in the gold mining industry of the Province, and are of the opinion that there are rich veins yet undiscovered, and that many that have been worked are not exhausted. Much of the mining of early days was necessarily of a desultory, unscientific character, but the application of principles evolved from a knowledge obtained from careful mapping and close study of different districts should lead to a revival of the industry.

INHABITANTS.

The inhabitants are the descendants of members of steady, industrious European races, who emigrated directly to this Province in the seventeenth, eighteenth, and nineteenth centuries, or came indirectly through the New England states.

The earliest settlers were Frenchmen who came out in the seventeenth and the early part of the eighteenth century, and made homes for themselves along the coast. In the area under consideration they settled chiefly in Yarmouth and Shelburne counties, at Chebogue, Chegoggin, Eelbrook, Tusket, Pubnico, Vaughan lake, Barrington, Shelburne harbour, and Port Latour, and a few settlements were made in Guysborough, as at the points where Guysborough and Sherbrooke villages now stand. The inhabitants of nearly all of these settlements were included in the general expulsion of 1755, with the exception of many who escaped and joined the Indians; their homes were destroyed and nothing left to mark their former occupation but a few small clearings and old cellars. When they were permitted to return, a few came back, and in 1768 the Acadian Frenchmen again settled along the south shore of St. Mary bay.

There are several villages in this part of Digby county in the French language is still spoken.

After the expulsion of the French, the English encourag[illegible] migration into the colony from the New England states, [illegible] 1759 immigrants began to arrive in Queens, and in 1761 [illegible] mouth. They settled in Yarmouth, Shelburne, and Queens [illegible] ties, and were afterwards joined by the United Empire Loy[illegible] Loyalists [illegible] settled in Guysborough, and thus in these four [illegible] ties the inhabitants are chiefly descendants of the English p[illegible] [illegible] settled by emigrants from England and other [illegible] pean [illegible] by disbanded soldiers.

From [illegible] a great number of emigrants from Germany [illegible] induced to settle [illegible] Lunenburg, and their descendants form a [illegible] proportion [illegible] inhabitants [illegible] that county. Some of the [illegible] people still [illegible] language.

A [illegible] r of men of Scottish descent are [illegible] found [illegible] Guysborough counties, and the counti[illegible] Pictou and Antig[illegible] and much of Cape Breton island were [illegible] tled by the Highl[illegible] n, who came over in great numbers [illegible] ing the last half of the eighteenth century, and the first two d[illegible] of the nineteenth. The Gaelic language is still spoken by ma[illegible]

Thus the population is made up of the descendants of the [illegible] adventurous, hardy, and liberty-loving representatives of the [illegible] European nationalities, and the sons of Nova Scotia have [illegible] marched in the van of industrial activity, education, and statesm[illegible] ship.

Many of the immigrants from New England and the Uni[illegible] Empire Loyalists brought negro slaves into the country with the[illegible] These were afterwards set free, and other free negroes entered [illegible] Province on the conclusion of the American Revolutionary W[illegible] Some 600 troublesome negroes were expelled from Jamaica in 17[illegible] and landed at Halifax where the most of them refused to ad[illegible] themselves to their new conditions, and were maintained at t[illegible] public expense until deported to Sierra-Leone in 1800. In 1815 Ha[illegible] fax was the landing place of a number of blacks who had be[illegible] received on the British squadron, blockading Chesapeake and oth[illegible] United States harbours. The most of these were subsequent[illegible] deported to Trinidad. The descendants of these different acces[illegible] ions to the negro race in Nova Scotia form the settlements no[illegible] scattered over the Province.

9869 p. 42

Typical gold miner's house

A description of the inhabitants would be incomplete without some consideration of the Indians, the aboriginal inhabitants of the country. The French who first settled in the Province found the silent forests occupied by the Micmacs, and entered into friendly relations with them. They heartily co-operated with the French in their struggle against the English, and bitterly harassed their enemies until a treaty was signed at Halifax in 1761 and peace was declared.[1] "The Indians then numbered about 2,000. The government assisted them with provisions, ammunition, and clothing. They hunted, trapped, and made baskets. They lived in birchbark wigwams, dressed in their own fashion, that had more than a touch of barbarism in it. . . . Within the last forty years they have rapidly adopted the usages of other people around them. Small houses and shanties have taken the places of the picturesque bark wigwams, their campfires have given way to old stoves, and men and women are largely clad in the cast-off garments of their white neighbours. Some of them try to farm a little; others act occasionally as guides, or build canoes, or catch salmon and trout; a few of the younger men are employed at times in the lumber woods and on the timber drives. They are not successful in the occupation of white men. They are lacking in steadiness of purpose and proper ambition. The old fibre and energy that belonged to their forefathers centuries ago is no longer in them. The blood of white men circulates in the veins of many of them, but such a commingling of races has not been attended with happy results." There are now 1,500 of them distributed over the Province, showing a decrease of about 25 per cent in 150 years. "There is no hope of any great improvement among them. A well-devised educational plan might rescue a remnant, but that is out of the question in these times when larger interests are clamouring for attention. The leopard cannot change his spots nor the Ethiopian his skin, nor can these people change their natural characteristics."[2]

The following table taken from the "Fourth Census of Canada, 1901," gives the origin of the inhabitants of the various counties of the Province.

[1] McLeod, R. R. Markland or Nova Scotia, p. 172, 1902.

[2] For fuller details regarding the inhabitants and their history, the reader is referred to "An Historical and Statistical Account of Nova Scotia," Vol. II, by Thomas C. Haliburton, and to "Markland or Nova Scotia", by R. R. McLeod.

CENSUS OF CANADA, 1901.

Counties	British.				French.	German.	Dutch.	Scandinavian.	Russian.	Austro-Hungarian.	Italian.	Jewish.	Swiss.	Belgian.	Half-breeds.	Indians.	Chinese and Japanese.	Negro.	Various origins.	Unspecified.
	English.	Irish.	Scotch.	Others.																
Annapolis.	13,915	1,057	1,146	38	231	1,209	563	10	...	...	2	2	...	...	18	27	3	569	...	52
Antigonish.	613	1,243	9,171	5	2,364	34	10	4	...	...	5	2	6	4	1	105	2	47	...	1
Cape Breton.	10,696	6,607	27,572	21	2,817	356	132	167	5	64	128	184	...	...	...	200	33	23	112	49
Colchester.	5,949	6,598	10,366	164	535	401	52	24	6	1	21	...	345	...	...	112	2	281	26	17
Cumberland	19,903	4,811	7,497	68	2,467	450	269	111	1	4	6	37	37	14	20	91	6	255	54	67
Digby	8,449	1,012	1,694	73	8,049	194	210	21		...	4	12	...	...	...	108	...	448	13	35
Guysborough.	6,346	3,267	4,950	6	1,537	1,250	142	13	1	...	8	7		2	...	44	...	664	16	67
Halifax city and county	32,092	15,603	11,429	149	4,229	7,402	909	176	27	13	71	120	19	2	12	130	29	2,045	121	84
Hants	8,602	3,534	5,827	74	174	1,348	136	12	1	1	4	...	...	...	1	61	2	242	7	30
Inverness	7,351	1,282	17,213	...	4,328	8	15	2	1	...	...	...	...	1	...	138	2	7	3	2
Kings	14,580	2,983	2,035		279	1,613	84	19	...	...	1	10	1	...		27	4	210	16	9
Lunenburg	4,942	989	1,181	66	2,131	22,709	42	39	10	6	21	29	4	...	2	32	4	38	15	25
Pictou	3,372	1,850	26,530	170	426	131	15	22	14	4	1	6	592	39	...	156	12	204	17	34
Richmond	875	1,232	4,519	34	6,678	18	12	25		...	2	...	...	...	...	131	1	11	8	1
Shelburne and Queens	14,275	1,393	3,212	2	391	3,822	258	34	2		11	12	...	...	33	94	3	525	39	13
Victoria	1,334	572	8,418	311	114	6	39	5	...	6	...	...	...	...	...	70	...		5	
Yarmouth	12,459	677	622	36	8,411	60	53	12	6	...	...	28	...	...	...	16	4	415	40	21

Micmac Indians.

GENERAL GEOLOGY.

GENERAL STATEMENT.

Regional.—With regard to geology, Nova Scotia appears to form a part of a large unit which includes Newfoundland, the Maritime Provinces of Canada, a portion of Quebec, and the highlands and coastal plain of the Atlantic states. This unity is apparent in the general northeast and southwest trend of the important geological features. The whole area has been subjected to similar orogenic forces giving a northeasterly trend to the topography and to the anticlinal folding; the greatest extension of the sediments is to the northeast and southwest, and even the igneous rocks have their greatest elongation in the same general direction. Elevation and subsidence have been repeated and formations representative of all the great geological eras from Pre-Cambrian to Quaternary are to be found.

In Nova Scotia, formations of the Pre-Cambrian, Palæozoic, Mesozoic, and Quaternary eras are found, but apparently no portion of the Province received any extensive deposit in Tertiary times. All these formations have their greatest extension northeast and southwest, as do also the granites and traps. In Cape Breton island the Pre-Cambrian age is represented by gneisses, and schists with crytalline limestone and dolomite at the top. Along the Atlantic coast of the mainland lie the closely folded slates and quartzites of the gold-bearing series, regarded by some as Pre-Cambrian, and by others as Cambrian in age. Upper Cambrian quartzites and slates are found in Cape Breton county, and Silurian limestones and dark shales occur in Antigonish and Pictou, and to a limited extent in Kings and Annapolis. A fairly continuous belt of Devonian quartzites and shales, with a few outliers, such as that in which the Nictaux and Torbrook iron ores occur, extend eastward from Minas channel through the southern part of Cumberland, the northern part of Hants, through Colchester, Pictou, Antigonish, and Guysborough into Richmond county. On each side of the Devonian lies a more or less broken belt of lower Carboniferous and Millstone Grit, having the same general direction of extension, the belt to the south extending from Windsor east into Guysborough, and that to the north stretching west into New Brunswick, and east into Cape Breton island. The lower Carboniferous consists of limestone,

gypsum, marls, and grey sandstones, the immense deposits fo
the basis of the gypsum industry of the Province occurring i
formation. The Millstone Grit consists of grey and red sand
and red shales, with some thin beds of carbonaceous shale.
Cumberland, Pictou, Inverness, and Cape Breton counties
isolated patches of Coal Measures consisting of sandstones,
shales, black carbonaceous and bituminous shales, and importan
beds, one of the greatest assets of the Province. Along the
of Northumberland strait lies a belt of rocks of Permian age.
the base these consist of conglomerates passing upward into
sandstone and reddish and grey shales with thin seams of coal,
higher up into calcareous beds. Lying between the North and S
mountains, and skirting the shore of Minas basin as far eas
Truro, is a narrow belt of Triassic conglomerates and red s
stone. This is the most recent consolidated formation to be fo
in the Province, but overlying all we have a mantle of Quater
sands, clays, and boulder clays, showing evidence of having
distributed by glacial action.

All the sediments show a greater or less degree of folding i
northeast and southwest direction, and those of earlier age t
lower Carboniferous or late Devonian have suffered consider
alteration.

Of the igneous rocks the granites of the gold-fields are the m
extensive, and these and the acidic igneous mass forming much
the Cobequid mountains were probably intruded in late Devoni
times. The North Mountain ridge consists of Triassic sandst
overlain by amygdaloidal and basaltic trap of Triassic age.

Local.—The gold-bearing series is the most southerly, and o
of the oldest sedimentary series in the Province. It extends alo
the Atlantic coast from one end of the peninsula to the other, i
creasing in width from a few miles at the east to 75 miles at t
west. Lying distributed throughout the gold-fields are numero
granite masses, the largest of which extends from the coast at Hal
fax northwestward and westward in the form of a crescent near
to the western end of the Province, dividing the sedimentary seri
into two parts, an eastern and a western. The sediments occup
about two-thirds of the whole area.

The sedimentary rocks consist of two conformable formation
of great thickness. The lower, known as the quartzite [1]or Golden

[1] Locally known as whin.

ville formation,[1] attains a thickness so far as known of 16,000 feet, and consists of alternations of quartzite and slate belts, which vary in thickness from a few inches to many feet. A few thin beds of coarse sandstone are known. The quartzite is grey and bluish-grey in colour, dense and fine-grained. It consists chiefly of silica with scales of mica and some kaolinized feldspar, and some beds have a calcite cement. The interbedded slates are of various textures and colours; some beds are unctuous and possibly talcose, some fine-grained argillaceous, and others quite arenaceous; the colour varies from greenish-grey, through light-grey and dark grey to black, the dark greys being predominant. Some beds of slate are heavily charged with pyrite, and in a few cases with arsenopyrite, and large crystals of both minerals are found in some beds of quartzite.

The upper formation, known as the slate or Halifax formation[2], has a thickness of 11,000 feet in the east, and is composed in the eastern part of the field of bluish-black, graphitic slate carrying considerable pyrite, also a few pyritous siliceous beds. At the base of the formation are found in some places a few beds of greenish slate with a soft smooth feel, and in two or three places a little limestone. In the western part of the field, in addition to the black slate division there has been recognized an underlying banded argillite division conformable on the quartzite or Goldenville formation. These are greenish-grey, light-grey, purple, and bluish-grey slates often showing conspicuous banding.

The sediments of the gold-bearing series have suffered much disturbance since they were deposited on the sea-bottom, and the attitude they now present is of beds tilted at high angles to the horizontal, and with a general east and west strike. They are folded in a series of long parallel anticlines averaging about 3 miles apart and with a trend approximately parallel to the Atlantic coast. In the eastern part of the Province the axes of these folds run nearly east and pass under the Atlantic, while towards Halifax and in the western part of the Province they tend more towards the northeast. The anticlines plunge at low angles to the east and west so as to form domes, which lie along the fold at points averaging 10 to 20 miles apart. The outcrops of the beds on these domes

---

[1] So named because of its occurrence at Goldenville, one of the most characteristic gold districts.

[2] So named because it is the formation on which the city of Halifax is built.

form ellipses, and beds can frequently be traced in a gentle from one side of the fold around the apex of the anticline opposite side. The folding in the east is greater than that west, so that the strata dip at higher angles to the north and

Very deep erosion took place during and subsequently process of folding, and the whole field, which was probably time a mountainous area, was reduced to what appears to hav a peneplain. The anticlinal ridges are now worn down to the same level as the synclines. So great has been the erosion the Goldenville formation is exposed in wide bands on near the anticlines, and even from a great many of the synclines, e ally in the eastern half of the field, the Halifax formation has removed. The latter formation in this part occurs general long narrow bands in the synclines, but in the western part o field it is more widespread on account of the folding not bein close and the consequent elevation of the series not so great.

The cleavage in the slates is generally quite pronounced stands nearly vertical and at right angles to the direction of a of the force that produced the folding. Many of the quartzite also are distinctly fissile.

The series has been much broken by a system of faults, w strike northwest and southeast, and many of which have been tr across the series. Several of these have a horizontal displacem of a mile or more. Those at the east are what are locally kn as left-hand faults, i.e., the displacement is in such a direction any particular anticlinal axis can be picked up on the opposite of the break by following the fault line to the left. The fault the weste n part of the field have not been so well traced, but seem to be generally of the kind known locally as right-hand fau In addition to these cross-country faults each mining district faults of a local nature depending probably on local features in rock structure.

The series had its origin in sediments deposited during a lo period of time on a slowly subsiding sea-bed. The subsidence t place so slowly that the area was at no time removed from sphere of deposition of continental sands and muds. Followi deposition came elevation, consolidation, and metamorphism, which the sands were converted into quartzites and the muds in slates.

The gold-bearing series is not found in contact with any rocks of Pre-Silurian age, and as no determinative fossils have been found, there is a difference of opinion as regards the age to which these rocks belong. Selwyn classed them as Cambrian, and since his time they have often been provisionally spoken of as such. Others, such as Matthews, Van Hise, and Woodman are of the opinion that they are Pre-Cambrian. The most of the folding probably took place in late Devonian times.

Granite is widely distributed throughout the gold-fields, and occupies a third of the area. It varies in composition and texture, being in some localities a fine-grained muscovite granite, and in others a coarse, porphyritic, biotite granite, with large phenocrysts of feldspar. Pegmatitic phases are also common. Some are of the opinion that two or more intrusions are represented.

That they are of later age than the gold-bearing series is shown by the fact that they carry inclusions of the latter, that numerous dykes from the granite penetrate the sediments, and that the sediments are much metamorphosed at the contact. They probably succeeded or were roughly contemporaneous with the folding of the sediments, but were earlier than the Horton series, which is regarded by some geologists as upper Devonian, and by others as lower Carboniferous.

A few other igneous intrusions are known, but they all take the form of basic dykes or sills, and are not important. One dyke occurs in Tangier gold district, and numerous dykes varying in thickness from a few inches to several feet are intruded in the slates of the west and are very common in Kings county.

The sediments are slightly altered at the contact with the basic intrusions, but contact metamorphism induced by the granite is intense and widespread. So complete has been the recrystallization in some places that it is difficult to determine the line of demarcation between the metamorphic rocks and the igneous. Gneisses, staurolite, andalusite and mica schists, and phyllites are common products of metamorphism.

West of Halifax a few exposures of Carboniferous limestone are met with along the shore of Margaret and Mahone bays, but they are of very limited distribution.

TABLE OF FORMATIONS.

Post-Glacial.............	Sands, clays, and gravels, redistribu stream action; peat.	
Pleistocene or Glacial.	...Sands, clays, and gravels; eviden three glacial epochs	
Lower Carboniferous......	Limestone, sandstone, and shale.	
Devonian.................	Granites; porphyritic, coarse-g biotite granite and fine-grained covite granite.	
?........................	Basic intrusions in the form of sill dykes.	
Cambrian (Pre-Cambrian?)=Gold-bearing series	Halifax formation.... of various colours textures.	
	Goldenville formation Interstratified quar and slates.	

DESCRIPTION OF FORMATIONS.

Gold-bearing Series.

DISTRIBUTION.

The two formations of this series are both widely distrib throughout the gold-fields. East of Halifax the Goldenville fo tion occupies over three-fourths of the area, the Halifax forma overlying it in long narrow zones extending east and west. V of Halifax the two formations are about equally distributed, the quartzite lies in zones, or elongated ellipses, having a north and southwest extension.

LITHOLOGICAL CHARACTERS.

Goldenville Formation.—As has been pointed out, this for tion includes all varieties of terrigenous sediments from fine m to coarse sandstones and conglomerates, but quartzite predomina and on this account it is frequently designated the quartzite for tion or group. The conglomerates are of very limited extent, a are found chiefly in the west. The formation consists of altern ing bands of quartzite and slate. While slate is distribu throughout the whole formation, there are, in some parts of

field, certain horizons in which it is somewhat more abundant than in others. It has been estimated that the slate forms 3 per cent or less of the total thickness exposed.

The quartzites exhibit all degrees of compactness from somewhat friable sandstone to the densest quartzite, but the latter is by far the most abundant, and the former very rare. The quartzite is a fine-grained, dense rock with a smooth conchoidal fracture, and with a colour variously described as uniform grey, bluish grey, dark green, and greenish grey. It consists chiefly of quartz, but some mica is visible and some beds are heavily charged with pyrite and mispickel, which frequently occur in large crystals. The weathered surface is stained by the oxidation of pyrite and arsenopyrite, or is light grey to white. Sometimes it is seen to be quite fissile and to approximate to a quartz schist.

The description given by [1]Jackson and Alger is interesting: "It is composed, as its name indicates, of siliceous matter, or quartz, which is fine granular, but more frequently compact, and breaks, not unusually, with conchoidal fracture. It is sometimes white, and its grains are transparent; but it generally has a greyish or bluish tint." In describing some of the quartzite of the western end of the Province they speak of it as "a fine fragmentary rock, consisting of granular quartz and feldspar united with grains of serpentine of a dirty green colour." Woodman points out that some beds which are of the nature of arkose, contain quite a little kaolin; the whole body has frequently been designated feldspathic quartzite.

With the hand lens abundant grains of dark or smoky quartz can be seen, and in some beds mica scales are quite numerous. From a study of these rocks in Halifax and Colchester counties, Woodman finds that a microscopic examination shows that [2]"secondary deposition of silica is slight, while chlorite and muscovite are developed somewhat; calcite is abundant, giving free effervescence with acid. . . . In some cases it is not possible to tell whether the muscovite is fragmental or secondary, because of the small size of the particles. Occasionally the sediments become chloritic schists or mica-schists, and in many more instances the microscope reveals distinct schistosity in a minute way." Faribault is of the

[1] Remarks on the Mineralogy and Geology of Nova Scotia, 1833, p. 321.
[2] Proceedings of the Boston Society of Natural History, Vol. 28, No. 15, p. 377.

opinion that Woodman's remarks regarding the development of calcite refer to only a few beds and are not of general application.

The origin of the calcite is not known. Three explanations suggest themselves, namely, that it is original, being the result of organic agencies, that it was introduced by infiltration, or that it resulted from the decomposition of the feldspathic components.

Of the slate belts of the Goldenville formation [1]Faribault states that "the principal varieties of slate are light-grey glistening mica-slate, almost wholly composed of mica; dark-bluish, papery, shining, fine micaceous slate; dull-grey, dirty, rusty, arenaceous, earthy slate; greenish, soft, unctuous slate with little mica; and bluish-black or dark bluish-grey compact siliceous slate, generally metalliferous and holding arsenical and iron pyrites in crystals or nodular masses, principally in the vicinity of auriferous quartz-veins, with which they are often associated." [2]Woodman says, "their colour is usually a bluish or greenish black, often altered by chlorite to a somewhat lighter green, or by the rusting of sulphides to a brown. Their commonest surface colour when well weathered is grey. . . The rock is in places graphitic, but not commonly, or so noticeably as in the overlying formation." He finds that at Moose river the pyrite in the slate lies chiefly along the bedding planes. Chalcopyrite also occurs in small quantities.

In some places there is no sharp line of division between the quartzite and the slate, the former passing gradually into a siliceous mica slate.

In addition to the quartzite and slates, there is a subordinate development of grits and conglomerates. [1]Hind mentions that, at some depth in the formation, coarse sandstones passing into a grit occur at Mount Uniacke and Waverley, and at the mouth of St. Mary river. At Mount Uniacke a belt 380 feet thick is very coarse at the base and passes upward into a very fine sandstone. The conglomerates are described under the heading "Metamorphic Rocks."

Halifax Formation.—This formation consists chiefly of slates of various textures and colours, a few siliceous flaggy beds and a very small amount of limestone.

The limestone, which is of an arenaceous dolomitic character, has been seen at two points at the base of the formation. On the

[1] Geol. Survey, Can., Ann. Report, Vol. II, Part P, p. 146
[2] American Geologist, July, 1904, p. 17.

shore at Southeast Passage P.O. it is found in a crystalline state interstratified with quartzite, in a belt several feet thick. It can be seen only at low tide, and lies just south of Wm. Wells' house. A bed 3 feet thick is found at the same horizon near Preston Road P.O., and was burned by the early settlers for lime. Almost anywhere east of Halifax, effervescence with acid shows the presence of calcium carbonate in a few beds at the base of the formation.

A few layers of greenish slate of fine texture and with a soft smooth feel, sometimes calcareous, are found at the base of the formation at different points in the eastern part of the Province, and they pass insensibly into the black overlying slates. The great mass of the Halifax formation in the east consists of "bluish-black, ferruginous and graphitic slates, easily distinguished from and unlike any others in the Province, having a characteristic fibrous texture. Certain flinty layers are full of arsenical and iron pyrites distributed through the mass in small, perfect crystals." The pyrite is frequently found in crystals along the bedding planes. Pyrrhotite is found in some beds, for example, near the lime-stone on the shore at Southeast Passage.

In the western part of the Province there is a greater variety of slates, and Bailey found it advisable to make three great divisions of the rocks of the gold-bearing series, but as his upper two divisions consist of argillaceous rocks and as the series has been divided into two great groups or formations since Campbell's time, it seems preferable to retain the old classification. Bailey's classification gives the lithological characters of the formations. It is as follows:—

ASCENDING SUCCESSION OF CAMBRIAN STRATA.[2]

"I. *Quartzite Division:*—

(*a*) Heavily bedded bluish quartzites, alternating with much thinner beds of grey argillite.

(*b*) Greenish-grey sandstones or quartzites, somewhat chloritic and less massive than in (*a*), and alternating with slates which are arenaceous below but become progressively more argillaceous above.

[1] Faribault, Geol. Survey, Can., Ann. Report, Vol. II, Part P, p. 147.
[2] Ann. Rep. Geol. Survey, Can., Vol. IX, Part M, p. 28.

"II. *Banded Argillite Division:—*

(*a*) Greenish-grey slates, becoming bluish or light-grey passing upwards into—

(*b*) Purple slates, marked in the lower beds by pale lowish-green seams, with faint bedding lines, which are wa in the higher beds.

(*c*) Bluish-grey and grey slates, often with clouding green, purple, lilac, buff or yellow, in places exhibiting a spicuous banding or ribbanding of the beds.

"III. *Black Slate Division:—*

Black with some blue or grey slates, often studded cubes of pyrite, and very rusty-weathering."

Speaking of the purple banded slates, Bailey says,[1] "The banding is often very conspicuous and the colours varied, inclu lilac-grey, bluish-grey, greenish-grey, buff, purple, light-grey, white, the proportion being in the order named." [2]"Wherever the yellowish-green seams show faint bedding lines, which here there are discontinued or replaced by purple slate for half an i or an inch." There is an [3]almost exact parallelism in the suc sion of the Cambrian beds, as seen on the Sissibou and in the tion from Marshalltown to the Joggins, [4]with that seen in parts Queens and Lunenburg counties, a parallelism which is not onl general one, but descends to the minutest details." In Ki county, on Black river, a tributary of the Gaspereau, is expose thick series of banded slates, greenish-grey in colour and with n row, siliceous bands of a lighter grey. At a lower horizon found some rather siliceous beds a few inches in thickness, whi show very fine cross-bedding. Correlation of the strata of the w with those of the east presents some difficulties, but Bailey's up division corresponds closely with Faribault's ferruginous, graphi division of the east, it being nearly always dark and often intens black, and graphitic, with an abundance of pyrite. It is possi that the "banded argillite division" of the west, although seve thousand feet thick, corresponds to the few layers of greenish, arg laceous and chloritic slate of the east found on Rawdon mounta

[1] Ann. Rep. Geol. Survey, Can., Vol. IX, Part M, p. 37.
[2] Ann. Rep. Geol. Survey, Can., Vol. IX, Part M, p. 80.
[3] Ann. Rep. Geol. Survey, Can., Vol. IX, Part M, p. 83.
[4] On Annapolis basin.

and the hills between Musquodoboit and Stewiacke river. The greater development in the west may be due to the greater proximity of that part of the ancient sea to the continent, and the banding may mark seasonal changes, and may be comparable to the 'laminations of the clays of northern Ontario.

STRUCTURAL RELATIONS.

Internal.—The importance of a knowledge of the structure of the gold-bearing series has been frequently emphasized from the earliest days of gold mining to the present. So strongly has this idea impressed itself on the minds of geologists and the mining public that it was considered advisable that, in spite of the extra expense, great care should be taken not only to show the distribution of the formations, but also to indicate their structure in the minutest detail possible on the map sheets that are being published on the scale of 1 mile to 1 inch, as well as on the plans of gold districts, published on a larger scale. The wisdom of this will be generally conceded when it is understood, as will be pointed out in the chapter of "Economic Geology," how intimately bound up with the geological structure is the distribution of the ore deposits.

The unravelling of the structure is by no means a simple undertaking. Only one horizon, the boundary between the two formations, can be traced throughout the field, and, while in the eastern part this boundary is sharp and distinct, in the western part it is not nearly so distinct and the transition from the Goldenville to the Halifax formation is much more gradual.

The structure of the Goldenville formation is more easily deciphered than that of the Halifax. The strata are frequently well defined and separated by films of slate, while, interlaminated with the quartzite, are also numerous beds of slate varying from a few inches to several feet in thickness. The strike and dip of the strata can thus be determined with some degree of certainty. Prominent beds of quartzite can be followed along the strike for some distance, but, owing to its general homogeneity, when a portion of a bed is concealed it is difficult to identify the exposed portions as parts of one and the same bed. In the mapping of the gold districts the interbedded veins of quartz have been of great service in ascertaining the rock structure. Especially is this the case with those dis-

[1] Baker, M. B. Report of the Bureau of Mines, Ont., Vol. XV, Part II, p. 20.

tricts that are drift-covered. and it is surprising what light been thrown on the structure of a district by the careful exam tion of the strata and leads in a few levels and cross-cuts dri in mining operations.

Much greater difficulty is experienced in the study of the st ture of the slates. The black, graphitic slates are very ho geneous, and the determination of the bedding planes is in m places almost impossible even to the most experienced observer. alteration from muds to slates has obliterated nearly all traces bedding and developed a marked cleavage that has in some ca been mistaken for bedding. In the vicinity of granite masses c tact metamorphism has effected such a marked alteration of th rocks that it is sometimes quite futile to attempt to make out th original structure. Occasionally a few beds are found that more siliceous than the rest, and these are of some assistance to geologist. In the western part of the fields, also, we have banded slates, and the different bands, varying in colour and textu represent variations in the character of the sediment deposited, render comparatively easy the determination of the attitude of rocks.

Traverses made across the gold-bearing series from north south show a succession of alternate zones of rocks of the Halif and of the Goldenville formation, varying in width from a fract of a mile to several miles. In the eastern part of the field width of the quartzite zones is generally much greater than that the slate zones, while in the western part the two formations more nearly equal in width. In the eastern half these zones exte in a general east and west direction, while in the western half th take a northeast and southwest direction. The slate zones of east take in general the form of much elongated ellipses surround by quartzite, while in the west the zones of quartzite are ellipti in shape and surrounded by slate, the ellipses in the latter ca being much broader than in the former. The strata strike in t same direction as the zones of quartzite and slate run.

In the east the zones of slate have a synclinal structure, a lie in the troughs of great east and west folds, along which t zones of quartzite are exposed. In some exceptional cases there another folding within the slate belt by which the centre of t slate belt is brought up in an anticline, and even an elliptical ou crop of quartzite may be found, as at Caribou. The wide zon

Apex of anticline showing bedding and cleavage in slate, and interbedded and cross veins, Cunard's cove, The Ovens.

See p. 56

of quartzite are frequently folded into two or more anticlines from the troughs of which all trace of the overlying slate formation has been removed. The rocks of the eastern part of the field are, therefore, seen to lie in a series of east and west folds, from which the greater portion of the Halifax formation has been eroded, so that it is now found chiefly in the synclines. The anticlines plunge to the east and west, and domes are numerous.

The quartzite ellipses of the west form the domed parts of anticlines plunging to the northeast and southwest. The slate surrounding the quartzite and overlying it is quite conformable with it. The structure is quite similar to that of the eastern part of the field; the strata are folded in long parallel plunging anticlines and synclines running in a northeast and southwest direction.

The chief difference between the structure of the east and west is that in the east the folds are much more tightly compressed than in the west, the strata in the east commonly dipping at angles varying from 60° to 90°, while those in the west dip at much lower angles. The result is that denudation has not reached to such low horizons in the west as in the east, and, while in the latter part of the field the Halifax formation has been eroded not only from nearly all anticlines, but also from the troughs of some synclines, in the former part the Halifax formation has been eroded only sufficiently to expose the Goldenville formation on the anticlines and generally only on the domes of these. Another result of the difference in attitude of the rocks of the two parts of the field is that in the west the domes are much broader and more nearly approach the circular form than in the east.

The maps published by the Geological Survey on the scale of 1 mile to 1 inch show the location of the anticlines and synclines, together with the dip and strike of the strata as determined by careful observations in the field extending over a period of many years. The folding is not nearly as simple as was at first supposed, and does not consist of a series of long parallel anticlines extending from one end of the Province to the other, or even the length of half of the field. While the anticlines are approximately parallel, they vary a great deal in length, from 3 or 4 miles in some of the local folds to about 105 miles in the Waverley-Moose River-Upper Seal Harbour fold. Sometimes two anticlines unite to continue as one, several subordinate crumples being formed at the place of union, as is the case with the Fifteenmile Stream and

Beaver Dam anticlines uniting at Moose River. Sometimes one anticline dies out only to be succeeded a short distance to the north or south by another that continues in the same general direction as the former, and that may properly be considered the continuation of the former as in the case of the Waverley and Moose River folds. Sometimes an anticline, like the Mount Uniacke-Renfrew, is broken up into a series of short folds arranged *en echelon* that combine to make really one great fold. Subordinate crumples a few miles in length on the limbs of the main anticlines are exceedingly common. The folding is thus seen to be very complex, and the correlation of a fold in one part of the field with that in another must be regarded as unreliable, unless they have been actually traced and found to be parts of the same fold. It is thus impossible to relate any particular fold in the western part of the field with any one in the eastern part.

It is impossible to give the total number of anticlines, since the western part of the field has not been mapped on a large scale. Even in the east it is probable that owing to the scarcity of rock exposures some of the subordinate folds have not been detected. In that section lying north of Halifax the anticlines are more numerous and closer together than in the section farther east. This may be due to the fact that the Halifax formation occupies a greater area here than farther east, the slates being more plastic and crumpling up into small folds more readily than the quartzites. The main folds are on the average about 3 miles apart, and the domes along the different anticlines are from 10 to 20 miles apart.

While the limbs of the anticlines dip at high angles and are frequently overturned, the plunge to the east or west is seldom more than 30°, and is generally much less. At Montague the plunge is west 5° and east 5°, at Tangier west 12°, at Harrigan Cove west 8°, at Lake Catcha west 28° and east 25°, and the north anticline at Isaac Harbour west 18°. The domes are seldom as symmetrical longitudinally as that of Montague, the plunge at one end being greater than at the other, for example the dome at Leipsigate plunges west 15° and east 30°. The plunge also varies greatly within short distances. In the Upper Seal Harbour district it is east 12° at Isaac Harbour river, and east 23° east of Upper Seal Harbour lake, within a distance of 2 miles; at Brookfield it increases from 10° to 18° east within a distance of 2,000 feet, and at Waverley, where the barrel quartz was mined, it increases from 5° to 24° west within

500 feet. This increase in the angle of plunge shows itself in the increase with depth of the angle of dip of a quartz vein that is being worked on or near the apex of fold.

It was at one time thought that these domes were produced by a second series of parallel anticlines crossing the east and west series at a high angle. There is, however, no alignment of these domes in a direction different from that of the east and west folds, nor does there appear to be any regularity in their arrangement, so that there seems to be little evidence of a second series of anticlines. It is probable that the plunging was produced at the same time as the main folds by a force acting nearly at right angles to the force producing the folds, but there was no regularity in the doming resulting from this force. It is not known what factors determined the location of the domes.

In that section east of Country harbour half the area is occupied by granite, and this intrusion has so metamorphosed the gold-bearing strata as to render difficult the determination of the structure. The folds are, therefore, not mapped with as much accuracy as those farther west. Between Canso and New Harbour river the strike of the rocks is N. 76° E., but from New Harbour river to Sheet Harbour river the strike is N. 84° E. As the sea-shore runs about southwest the folds, therefore, pass eastward under the Atlantic. That section lying between Country Harbour and Sheet Harbour rivers has been much less affected by igneous intrusions and the structure was less difficult to determine. This section has suffered very little extensive faulting and the folds are more regular, more nearly parallel, continuous, and evenly spaced than in any other portion of the eastern half of the field. From Sheet Harbour river west to the large granite batholith that divides the gold-fields into halves, the series has suffered much from faulting and from igneous intrusions, and there is much less regularity in the structure. The folds continuing into this section from the east are greatly faulted, and in the end die out, to be succeeded by others more numerous, shorter, and less regular. In the western part of this section they are more numerous and closer together than in any other part, due possibly to the greater abundance of slate exposed here. They are also inclined more towards the northeast and southwest than those farther east, and assume more nearly the direc-

tion of those folds of the western half of the Province. The series of folds, therefore, extending from one end of the Province to the other form a broad curve with its concave side facing the Atlantic.

The following table of the most important anticlines and gold districts has been compiled by Woodman from the sheets published by the Geological Survey:—

(1) [1]"The Tangier fold with Ecum Secum, Harrigan Cove, and Tangier; (2) the Ecum Secum fold, a very local one, with a part of Ecum Secum; (3) the Lake Catcha-Salmon River fold, including Liscomb Mills, Salmon River, and Lake Catcha; (4) the Mooseland-Gegogan fold including Mooseland and Gegogan (Lawrencetown may be on a westward continuation); (5) the Wine Harbour fold with Wine Harbour; (6) the Montague-Isaac Harbour fold with Montague, Gold Lake, Killag, Goldenville, and Isaac Harbour; (7) the Moose River-Beaver Dam fold, with Beaver Dam, Upper Seal Harbour, Ragged Falls, and Moose River; (8) the Waverley-Fifteen-mile Stream fold, with Waverley at the west, running through Moose River, where it parts company with 7, to Fifteenmile Stream; (9) the Caribou fold, containing Caribou, Cameron Dam, Crowsnest, and Cochrane Hill; (10) the Oldham fold, with Oldham; (11) the South Branch Musquodoboit fold, with an unnamed dome and Little Liscomb Lake mine; (12) the South Uniacke fold, with South Uniacke; and (13) the Mt. Uniacke fold, with Mt. Uniacke and Renfrew."

The structure of the western half of the gold-bearing series has not been so thoroughly worked out as that of the east. A map was published in 1898 of that portion of the Province extending west from Port Medway harbour and Torbrook on the scale of 8 miles to 1 inch, showing the geological boundaries; but the geological structure is not indicated. Much field work has been done preparatory to mapping the western half of the fields on the scale of 1 mile to 1 inch, but with the exception of the Aspotogan sheet, No. 70, the results have not yet been published.

Much difficulty has been encountered in determining the structure. This is due in great part to the greater proportion of the Halifax formation and the scarcity of exposures in some sections as compared with the eastern half of the field. And the difficulty is not in the least decreased by the metamorphism that has taken

[1] Trans., N.S. Inst. Sc., XI, p. 165.

place in the vicinity of the granite intrusions and by the probable occurrence of numerous faults, many of which it is possible to trace in detail, as in that section south of Wolfville and Kentville.

The most important feature of the structure is the exposure of the Goldenville formation in broad elliptical domes. This is particularly noticeable in Lunenburg and Queens counties. These domes are important, as it is on them that the gold deposits are found. The lateral compression has not been so great here as in the east so that the strata dip at lower angles, and the domes are much broader, and in some places approximate a circle. The longer axes of these domes run northeast and southwest, and the domes run roughly in lines parallel to each other and having the same direction as their longer axes, thus showing a tendency towards the long continuous anticlines to be found in the east. However, on account of the discontinuity of the exposures of the thick beds of quartzite the folds do not show the same continuity here as in the east. There is a tendency for massive and inflexible beds of quartzite to exhibit the effects of great lateral pressure by forming in large and continuous anticlines. The more plastic beds of slate or shale, subjected to the same conditions, tend to form small crumples or anticlines of less extent and less continuity, and by responding more completely to the minor stresses and pressure manifest a great deal more irregularity than quartzites, rising in some places, as on South cove of Lunenburg harbour, in marked cross folds running north and south. In the western part of the field the domes of quartzite are surrounded by slates and a single fold in the quartzite frequently divides into two or three smaller ones as it passes into the slate.

The structure of the gold-bearing series found in Kings county was more easily determined, on account of the great number of exposures and of the outcropping of quartzite of the Goldenville formation along the anticlines, and of two well defined beds of quartzite high up in the Halifax formation. There are three anticlines having a northeast direction.

The north anticline runs southwest from Kentville along the crest of Green hill immediately north of Mill brook, crosses Tupper lake, and is cut off by the granite 2 miles farther west. It again shows 6 miles farther west, on the Aylesford road south of Morristown. It plunges east and the Goldenville formation extends from Tupper lake west, having a width of 2 miles on the Aylesford road.

The south anticline lying on the hill from 2 to 3 miles south of Gaspereau river starts at the granite south of Sunken lake and runs northeast, crosses Black river between the first and second bridges, passes between Union Street post-office and Schofield corner, and crossing the headwaters of Halfway river and Duncanson and Harding brooks is concealed by the Horton series. It plunges to the east and the Goldenville formation extends as far east as Union street, being a fourth of a mile wide in Black river. It is said that auriferous quartz was discovered on this anticline in 1868, but it has not been well prospected.

The middle anticline running half a mile north of Gaspereau river crosses the Deep Hollow road three-fourths of a mile north of Whiterock post-office and extends easterly along the north side of the Ridge road to where it is concealed by the Horton series opposite Wolfville. It extends southwest past the junction of the Highbury road and the road leading from Whiterock to New Canaan. There are many subordinate crumples on this fold, which plunges west and is composed only of the Halifax formation.

The degree of folding has already been touched upon, and it has been pointed out that the anticlines in the western part of the field are not nearly so closely folded as those in the eastern part. No good sections of the western part have been published, but nearly all the map sheets of the eastern part are accompanied by sections showing the nature of the folds. These consist almost exclusively of closely folded anticlines with the strata dipping at very high angles. Some few of them are quite symmetrical, but the most of them are more or less unsymmetrical, that is, they have the axial plane inclined away from the vertical. In a few cases, as in the Killag gold district, the axial plane is inclined from the vertical at a rather large angle and the strata on the one side are overturned, so that both limbs dip either to the north or south according to the inclination of the axial plane, and we thus have an inverted fold. It is worthy of note that the most of the unsymmetrical folds have their axial planes dipping to the north so that the limb dipping at the highest angle is on the south side of the fold. However, this cannot be made a rule, and an anticline with its axial plane dipping to the north may be succeeded to the north or south by one having its axial plane inclined either to the north or south, or vertical. The inclination of the axial plane of an anticline does not continue the same throughout its length, and there is thus more or less torsion

in the fold. For instance, the axial plane of the Mooseland-Gegogan anticline is nearly vertical in the Mooseland gold district, but north of Sheet harbour it dips north and is inclined at a high angle from the vertical. So also, the axis plane of the Killag-Goldenville anticline dips to the north in the Killag gold district so as to form an inverted anticline, but farther east the dip is not so far from the vertical, and there is no inversion. In some places a succession of three or four anticlines with their intervening synclines shows the fan structure, but examples of such are rare. There is an example of this north of the Fifteenmile Stream gold district. The axial plane of the Caribou-Cochrane Hill anticline dips north at a high angle from the vertical, that of the next syncline to the north still dips north, but nearer the vertical, that of the Big Liscomb Lake anticline is about vertical, while those of the syncline to the north and of the South Branch Musquodoboit anticline dip to the south, the succession producing a fan structure.

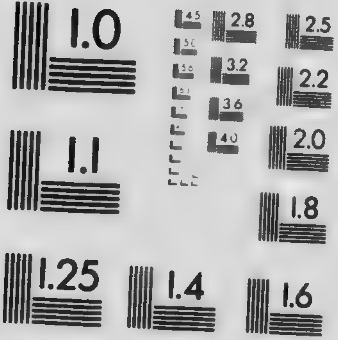
This series has suffered a great deal of faulting and the fractures may be grouped into two classes, cross-country faults and local faults.

The local faults are those that are found in the separate gold districts, and do not continue for great distances on the strike, and sometimes to only shallow depths. They seem to be closely related with the doming of the anticlines, and are very frequently found to radiate from the centre of the dome. Good examples of these are found in the eastern part of Oldham gold district. In many gold districts the rocks are fractured considerably in lines radiating from the centre of the dome and diverging to the north and south of the main axis. Owing to the uniform character of the strata and the consequent lack of datum planes, the direction and extent of motion along the faults is difficult of determination and thus when a pay-shoot is followed to a fault much money has frequently been lost in recovering it beyond the break.

The cross-country faults are those that can be traced several miles across successive folds. They form a series of breaks approximately parallel. In the eastern half of the gold-fields and in Kings county the most important of these have been traced along the [illegible]. In the western half either there have been few extensive faults, or they have failed to leave such marked traces on the slates of this part as they have on the quartzites of the east, or it is impossible to trace them on account of the covering of drift. The faults

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



that have been traced are practically all found to strike northwest and southeast at an angle quite removed from the perpendicular to the strike of the strata. Nearly all those in the eastern half of the field are known as left-hand faults, that is the displacement is such that a bed of rock followed to a fault can be picked up by turning to the left and following the strike of the fault. Those in Kings county, on the contrary, are right-hand faults.

In tracing these faults across the country the few datum planes available, such as the boundary between the two formations, or the bed of quartzite in the Halifax formation in Kings county, have proved of great service. Other phenomena that have been of assistance are the brecciated and twisted character of the rocks, the alignment of stretches of low ground and swales due to the increased erosion along fault lines, and the numerous cold water springs no doubt issuing from fault crevices. In some cases the rivers and brooks have followed faults for varying distances, and rendered the determination of their location extremely easy. The faults have determined the remarkably straight courses of some of the rivers.

On account of the great homogeneity of the rocks much difficulty would be encountered in determining the exact direction and extent of the motion along the fault plane. It is very probable that displacements in all directions are represented: horizontal, vertical, and oblique. The obliquity of motion in some cases is plainly shown by the direction in which the strata are bent as they approach the break. In the majority of cases, however, only the extent and direction of the horizontal displacements have been determined, and these are indicated on the map sheets.

Some of the most important of these faults are:—

(1) One following the straight course of New Harbour river and giving a left-hand horizontal displacement along the strike of over a fourth of a mile.

(2) Country Harbour fault with a displacement along the strike of 1½ miles.

(3) Indian Harbour fault giving a displacement on the strike at the Wine Harbour anticline of nearly a mile, but probably less than a fourth of a mile just west of Crowsnest mine.

(4) One running northwest from Shears cove west of Harrigan Cove gold district, through Eagle lake and Salmon River Big lake, east of the granite mass exposed at Mulgrave hill, to the vicinity of Tenmile lake. This gives a left-hand displacement

along the strike of a little over half a mile near the coast, but apparently a right-hand displacement of 2 miles or more to the South Branch Musquodoboit anticline. There is some doubt, however, about the structure of the rocks on each side of the granitic mass about Tenmile lake.

(5) Sheet Harbour fault, running from a point southeast of Beaver Harbour northwest through Sheet Harbour, and roughly following the course of West River Sheet Harbour. It dips to the southwest and gives a left-hand displacement along the strike of 1¼ miles to the Tangier-Harrigan Cove anticline, half a mile to the Mooseland-Gegogan anticline, 1¾ miles to the Moose River Fifteenmile Stream anticline, and half a mile to the Caribou-Cochrane Hill anticline.

(6) One running from River lake northwest through Mooseland gold district and the abandoned Icelander settlement and giving a left-hand displacement along the strike of a fourth of a mile to the Moose River-Beaver Dam anticline.

Other faults occur to the west of these of considerable local importance, but not so continuous as the above. The numerous faults of Kings county have a horizontal displacement varying from a few feet up to 900 feet.

In addition to the folding and faulting produced in the rocks by the forces to which they were subjected, other phenomena such as brecciation, cleavage, jointing, and fissuring have resulted from the same agencies.

It seems probable that the innumerable quartz veins lying in the stratification planes had their origin in the deposition of quartz in fissures produced by the close folding and the consequent slight slipping of the strata upon one another. The fissures in which such cross-veins as those at Cow Bay, Leipsigate, and Brookfield were deposited, are also probably due to orogenic movements, but like those in which the interbedded veins were deposited, are quite local. In some cases, as at Leipsigate, the fracture strikes in a direction differing little from that of the strata, but dips towards the centre of the dome. Some cross-veins like those at Central Rawdon and West Gore lie in fault planes, and it is not always possible to determine whether a break is a simple fissure or a fault.

The jointing of the series appears to be affected by local structure. In general the joints in the beds of quartzite run in directions at right angles to the axis of the anticline, and appear to have

been produced by the bending of the strata on the fold. The are usually wedge shaped and widest at the top. They are som times filled with quartz veins.

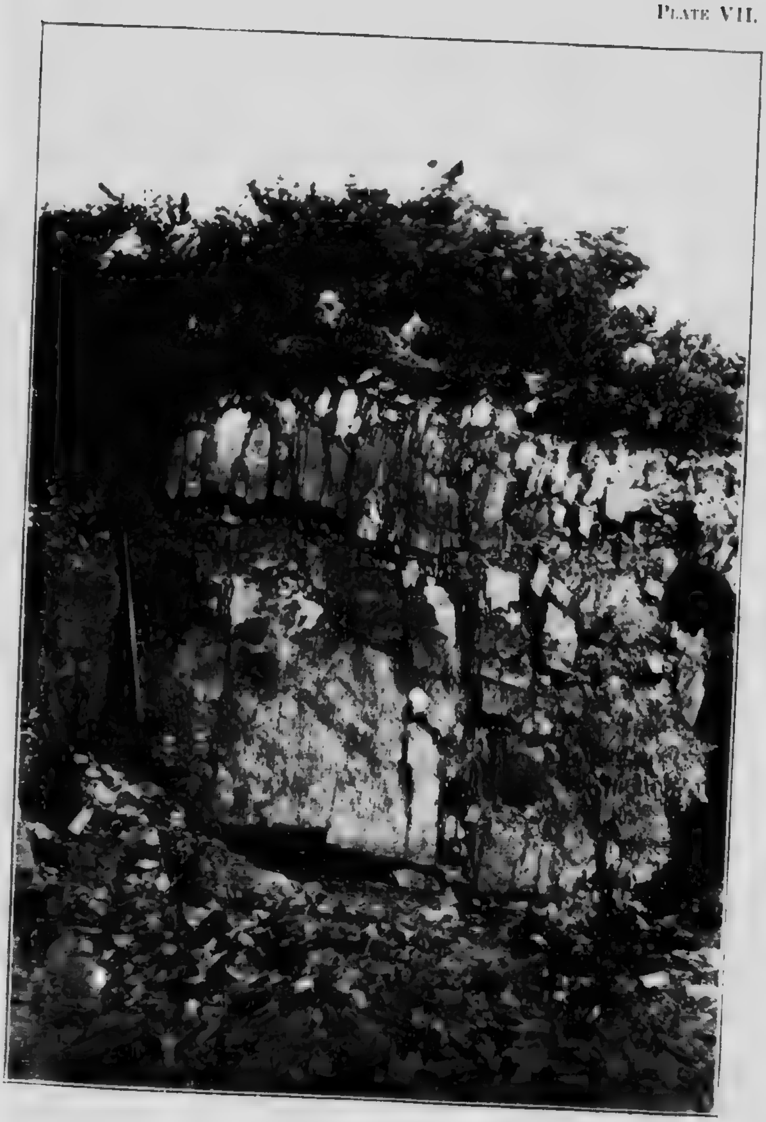
Cleavage has been well developed throughout the field. As rule the quartzite is poorly cleaved, but weathering brings it o and shows it in its incipient stage. In some places it has be squeezed into a sort of quartz schist and fissility is quite appare The slates show good cleavage.

The planes of cleavage are parallel with the general strike the rocks, and are highly inclined, but are often several degrees fr the vertical. It is a noteworthy fact that in the vicinity of an an cline the planes of cleavage dip towards the centre of the fo This fact is frequently taken advantage of to locate the anticli when the bedding planes cannot be determined, the planes of clea age dipping in a direction opposite to those of the strata. In tho slate beds carrying corrugated quartz veins the cleavage is f quently found to curve aside on approaching the crest of a crenu tion. Distinct serrations are frequently found along beddi planes, and are due to motion along the cleavage planes, and it m be that some of the crenulations found in the quartz veins are d to the same cause.

Since the cleavage is nearly vertical, the angles formed by t cleavage planes and stratification planes in high-dipping strata a very acute, but in low-dipping strata they approach a right ang The combined effect of cleavage jointing and stratification is cause the rocks, especially the quartzite, to break into rhombohed blocks. Since the angle formed by the cleavage planes and strati cation planes is dependent on the attitude of the strata it is evide that the acuteness of the rhombohedrons is also dependent on t attitude of the strata from which they were derived. A clo examination of the loose blocks will, therefore, serve as a clue the attitude of the strata, from which they are derived.

Owing to the slate of the Goldenville formation being m plastic than the quartzite, the thickness of any particular bed the former is by no means uniform throughout a fold. At t apex of the anticline it is often much thicker than on the li As folding proceeded there was some sliding of the beds upon o another, pressure at the apex of the folds was somewhat reliev and the slate was squeezed from the limbs to the apex. The res was a thinning of the slate beds on the limbs and a thickening

PLATE VII.



Quartzite s...g cleavage perpendicular to the bedding, Ecum Secum.

98-9 - p. 66

Corrugated vein showing deviation of the cleavage in the slate approaching the corrugations, Moose river.

the apex of the fold. In some places the pressure was great enough to force all the slate aside and bring the beds of quartzite together.

Estimates of the relative proportion of quartzite and slate in the Goldenville formation are hard to make. Much of the ground is covered with drift, good continuous sections are scarce, and there is probably a great deal of discontinuity in the beds. In some places a continuous succession of quartzite beds with scarcely any slate may be found several hundred feet thick, as at Mount Uniacke. On the other hand there are some places in which the slate is very abundant, as at Moose River, where in several parts of the district trenches show 50 per cent slate. [1]Woodman has estimated that the slate composes 3 per cent or less of the total thickness exposed.

Owing to the high tilting of the beds and the subsequent erosion, geologists have been able to calculate the thickness of the exposed portion of the gold-bearing series. This series has been found to be of immense thickness. Faribault has estimated the Goldenville formation exposed north of Moose River as 16,000 feet. Of this formation, Woodman says:—

"The two best localities for measurement, in eastern Nova Scotia, are from the Moose River anticline, at its bifurcation a mile west of Moose River mines, north to the contact of the Halifax formation; and from the more northerly of the two branches into which that axis breaks, 5 miles west of Fifteenmile Stream gold district, north to the contact with the Halifax. The former gives 16,730 feet, the latter 17,670 feet as the exposed thickness of the Goldenville. Strike faults are extremely rare in the Meguma series, and small where found. The traverses made for the purpose of estimating thickness were along lines giving numerous outcrops; and no evidence whatever was found, which would warrant [illegible] in eit[illegible] or faulting along the lines of measurement."

Work done [illegible]t in Kings county in 1908 shows that [illegible]ailed [illegible] of the slates measured along Black river from the [illegible] rock to the two bands of Whiterock quartzite, and along the Elderkin brook from the same quartzites to the highest slates [illegible] the syncline, gives a total thickness of about 14,500 feet of strata.

American Geologist, XXXIV, p. 17.
American Geologist, XXXIV, p. 16.
The name given by Woodman to the gold-bearing series.
Geol. Surv. Can. Summary Report 1908, p. 152.

Of this thickness, the lower 11,700 feet correspond in character an thickness to the upper or Halifax division of the gold-bearing seri of the Atlantic coast, and the remaining 2,800 feet, from the ba of the two bands of quartzite, are probably a sedimentary series n represented along the coast. If we add to this thickness the 16,0 feet of whin rock, that is, of the Goldenville division as exposed Moose river, we have a total thickness of 30,500 feet for the whole [1]W. H. Prest from a series of careful measurements along the Sis boo river estimated the thickness exposed as 28,000 feet, but Bail expresses the opinion that in view of the many possibilities of err among rocks so highly folded and faulted it seems to him the est mate is too high. So although geologists differ as to the exa measurement all are agreed on the extreme thickness of the seri

The above are calculations of the thickness of the exposed po tion of the gold-bearing series, but it is impossible to determine t thickness of the whole series. In no place has the bottom of t Goldenville formation been found, nor is it at all probable that t highest strata found in the synclines represent the youngest be of the series. While erosion on the anticlines has been so exte sive as to expose strata at Moose river 16,000 feet below the top of t Goldenville formation, it is more than probable that extensi erosion has also taken place in the synclines, and it may be that t highest strata now exposed in the syncline were at one time bu under several thousand feet of sediment.

External.—No rocks of greater age are found at any place contact with the gold-bearing series, so the discussion of extern relations must be limited to a treatment of the relation of the rocks to those of more recent age.

The series is intruded by more or less basic rocks taking t form of dykes or sills lying chiefly in the stratification plan These are limited almost wholly to the western half of the field. T series is also intruded by numerous masses of granite, the lat age of which is shown by the marked metamorphism induced in t gold-bearing series at the contact. The relations of these intr sives to the series are fully described elsewhere.

In Annapolis and Digby counties in the western part of t Province the gold-bearing series lies in contact with a series of slat and quartzites that are believed to be of more recent age. Th

[1] Geol. Sur., Can., Vol. IX, p. 83. Part M.

are the rocks of the Nictaux-Torbrook basin and of the Clementsport and Bear River basin. They have received a great deal of attention and numerous collections of fossils have been made from different horizons of the series. J. W. Dawson described the rocks and their fossils, and more recently Dr. Ami examined carefully groups of fossils collected by H. Fletcher, L. W. Bailey, and A. H. McKay. Some of the groups of organic forms are of a purely Silurian aspect, others early Devonian, while others show a mixture of Silurian and Devonian forms and are, therefore, transitional. This is quite in accord with the stratigraphy of the district, which indicates a perfectly continuous and conformable series of beds. These rocks are folded so that the strata dip at high angles and strike east and west as do those of the gold-bearing series. In the Clementsport and Bear River basin this series is found in contact with the gold-bearing series, but it has been found impossible to draw the dividing line between the non-fossiliferous strata of Siluro-Devonian age and those of the undoubted gold-bearing series. A detailed description of the later rocks, with evidence regarding their age, is given in the Annual Report of the Geological Survey, Vol. IX, Part M, pp. 87-124.

The relation of the gold-bearing series to the Dictyonema slates south of Kentville is discussed in the chapter dealing with the age of the series. These Kentville slates were thought by Dawson to be a continuation of the series exposed in the Nictaux-Torbrook basin, but according to Bailey no Dictyonema or graptolitic forms have been found in either the Nictaux-Torbrook or the Clementsport and Bear River basin. A zone of the gold-bearing series intervenes between the Dictyonema slates near Kentville and a narrow band of Silurian strata south of New Canaan. These latter consist of fossiliferous, highly-altered, impure limestones and have been subjected to a close east and west folding similar to that of the underlying Halifax formation.

Sediments of Middle Devoni[illegible]e lie in contact with the gold-bearing series along the lower co[illegible] of Salmon river flowing into Chedabucto bay, and again for a few miles east of the Eastville settlement on the Stewiacke river in Colchester county. These consist of sandstones, shales, and slates, and along Salmon river conglomerates are found in which pebbles of whin are common. The attitude of the strata is not at all conformable with that of the gold-bearing series.

West of Avon river and south of Horton, as well as farth east, the Horton series comes in contact with the gold-beari rocks. The lowest beds consist of very coarse grey sandsto passing into an arkose resulting from the breaking down of t granite. There are also some shales, the material of which h been derived from the slates of the Halifax formation, but pebbl are rare. These strata, although folded to a certain extent, r on the upturned edges of the strata of the gold-bearing series, a the two are quite unconformable.

Extending eastward from the line between Colchester a Pictou counties to the Salmon river is a narrow band of sedime indicated on the map-sheets as Carboniferous conglomerate. Th band lies in contact with the gold-bearing series at the south. consists of shales, sandstone, and conglomerates. "Overlying t whin or quartzite of the gold-bearing series in the brook flowi from Hurley lake, come grey fine sandstones and grits like th seen on the Salmon River roads, interstratified lower down wi rough, coarse conglomerate composed of pebbles and large bould of whin. In other branches of Country Harbour river, simil rocks are found." The conglomerates found in Big Barren br also contain pebbles derived principally from the gold-beari series. These carboniferous conglomerates are folded in obsc northeast and southwest anticlines, but the attitude of the str is quite different from that of the gold-bearing series, and th are unconformable.

With the exception of a small stretch of Devonian rocks, t Carboniferous limestone (Windsor series), forms the northe boundary of the gold-bearing series from Avon river to Eastville the Stewiacke, and it also lies in the upper valley of the Musquo boit river. This series consists of limestone, marl, sandstone, a immense deposits of gypsum. Basal conglomerates at the cont with the gold-bearing series are exposed in places. For examp at Newton Mills the red hematite is in a conglomerate containi pebbles of whin, and the ancient placers at Gay river consist of basal conglomerate containing pebbles of the gold-bearing serie

Small patches of lower Carboniferous rocks are found sc tered around Margaret and Mahone bay, where they rest on t granite or unconformably on the gold-bearing series as shown the further description of rocks.

letcher, Geol. Sur., Can., Vol. II, p. 76.

To the Pleistocene deposits the relation is also one of unconformity, the loose material redistributed by the glaciers lying on the upturned edges of the gold-bearing series.

MODE OF ORIGIN.

These sediments were deposited on a slowly subsiding sea bottom. Details will be given under the heading 'Historical Geology.'

AGE.

The determination of the age of the gold-bearing series is a problem that has vexed all investigators, who have applied themselves to its solution. The almost total absence of organic forms makes it impossible for the palæontologist to throw much light on the subject; lithological resemblances may be suggestive, but can hardly be regarded as determinative; of the contiguous formations the oldest seems to be upper Silurian; Nature, therefore, it would appear, has propounded a problem for the solution of which she has given insufficient data.

Certain markings or forms have been discovered from time to time, and have been hailed with delight as organic and as giving some indication of the age of the rocks, but these have in many cases turned out to be nothing more than concretions,[1] or their organic origin has been disputed, and none have been characteristic enough to be of any determining value. Hind in his report on the Waverley district in 1869 mentions the discovery of *Palaeotrochus major* and *Palaeotrochus minor*, besides numerous concretionary forms, but these have long since been shown to be inorganic.[2] Certain other nodular bodies and markings discovered in the quartzite by Hind and referred with doubt by Billings to the genus *Eospangia* and to casts of *Orthis*[3] "consist of little oval depressions surrounded by a raised ridge from which radiate a number of raised lines sometimes bifurcating." They vary in size from 1 inch to 6 or 7 inches in diameter, and appeared to Dawson to be fucoids with radiating fronds, for which he proposed the name *Astropolithon*, and the Waverley species *Astropolithon Hindii*, in honour of the discoverer. The same form has been found in other localities, but some doubt has been expressed as to its organic origin. Another

[1] Weston, T. C., Trans. Nova Scotian Inst. Sc., Vol. VIII, p. 137.
[2] Woodman, Bulletin of the Geol. Soc. of American, Vol. 19, p. 102
[3] Dawson, Supplement to Acadian Geology, 1878, p. 82.

supposedly organic form was found by Selwyn "in the grey sandy and flaggy pyritous slates" at the Ovens Bluffs, Lunenburg county, and was referred by Billings to the genus *Eophyton*, a species of plant, but as [1]"none of the specimens exhibit internal structure, this view does not meet with general acceptation, and the theory that they are trails or tracks of marine animals seems to find more favour." Some have questioned the organic origin of these also. Dawson [2]noted that some loose quartzite blocks near the mouth of St. Mary river bore perforations resembling Scolithus, and Bailey mentions some forms occurring in the black slate drift near Bridgewater and also on the coast near Heckman island, Lunenburg county, which [3]"bear some resemblance to brachiopods of the genus *Obolella* or *Linnarsonia*, but they are lacking in markings or other distinctive features by which their nature can be definitely ascertained." In 1902 Henry S. Poole [4]exhibited to the members of the Nova Scotia Institute of Science a slab of slate from the syncline at Greenbank, Point Pleasant park, Halifax, bearing markings which resemble annelid tracks and burrows; this interesting slab is preserved in the provincial museum, Halifax. The above is a summary of the most important discoveries of a possibly organic nature, but, although they influenced the discoverers in naming the series, they can hardly be regarded as having any stratigraphic value.

The series has been referred by different writers at different times to various ages from Pre-Cambrian to lower Silurian.[5] Jackson and Alger marked it on their map (1832) as "Transition Clay Slate," and Gesner[6] (1843) referred it without reasons to the Cambrian. Dawson on the map accompanying his first edition of Acadian Geology, 1855, indicated this area as "perhaps altered lower Silurian" strata, and in a supplementary chapter to the same edition he suggests that it may be a continuation of the Primordial zone of Newfoundland, which afforded trilobites of the genus *Paradoxides*. Prof. H. Hind after the discovery of *Palaeotrochus* at Waverley considered the series as occurring near the base of the lower Silurian system. Selwyn points to their resemblance to the Cambrian and Lingular flag series of North Wales.

[1] Report of Progress, Geol Sur., Can., 1870-71, p. 269.
[2] Supplement to Acadian Geology, p. 83.
[3] Bailey, Ann. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 46.
[4] Trans. N.S. Inst. Sc., Vol X, p. 453.
[5] Walcott, Correlation Papers, Bulletin U.S. Geol. Sur., 81, p. 5[illegible]
[6] Geol. Soc. London, Proc., Vol. 4, 1843, pp. 186-190.

[1]"The lowest members of the series (Cambrian) there consist of a succession of thick bedded greenish-grey feldspathic grits and sandstones or quartzites, with intercalated slaty bands; and these are conformably overlaid, as the similar beds are in Nova Scotia, by a set of black earthy and pyritous slates and sandy beds (the Lingula flags)." Dawson in his supplement to Acadian Geology, edition 1878, says that he believes the series to be "Cambrian or Primordial, a view which Mr. Selwyn and Prof. Hind have also advocated." [2]Walcott says it is probable that the Cambrian system is represented by the gold-bearing series of Nova Scotia, but that it may be in large part Pre-Cambrian, equivalent to the St. John slates of Newfoundland.

Different authors have pointed out the resemblances existing between the gold-bearing series of Nova Scotia and the Pre-Cambrian slates and quartzites of the Avalon peninsula of Newfoundland. The following section in descending order is that given by Murray of the Newfoundland series, which he classes as the Intermediate System, equivalent to the Huronian of Canada:—

[3]Dark brown or blackish slates, ripple-marked..	2,000 feet.
Green, purple, pinkish or red fine-textured slates in frequent alternations..	3,300 feet.
Slate conglomerate and slate..	1,650 feet.
Diorites, quartzites, and jaspery bands..	1,300 feet.

In the same report (p. 167) Murray states that the resemblance between this system and the gold-bearing series of Nova Scotia "is too striking and marked to be overlooked, and the inference is that on further inquiry it will prove to be of the same horizon."

Van Hise[4] says that the gold-bearing series may be as late as Cambrian, but that there is a strong probability of their being of Pre-Cambrian age. In favour of this view is the extreme scarcity of fossils in the quartzites and slates, while there is an abundance of fossils in rocks of undoubted Cambrian age in the same region. He points out the marked similarity existing between the gold-bearing rocks of Nova Scotia and the folded and cleaved slates and quartzites of the Avalon series of Newfoundland. The latter are certainly Algonkian, being overlain unconformably by Cambrian

[1] Selwyn, Rep. of Progress, 1870-71, p. 271.
[2] U.S. Geol. Survey, Correlation Papers, 1891, Bull. 81, p. 262.
[3] Geol. Survey of Newfoundland, p. 145 (Report for 1868.)
[4] Principles of North American Pre-Cambrian Geology, Sixteenth Ann. Rep., U.S. Geol. Sur., p. 811.

rocks, and there is a strong probability that the lithologically and structurally similar rocks of Nova Scotia were deposited at the same time.

G. F. Matthew[1] holds the view that they are of lower Huronian age. The Cambrian terrane of southern New Brunswick agrees almost exactly in the succession and aspect of its members with that of the corresponding terrane of Cape Breton, but does not at all agree with the gold-bearing series of Nova Scotia, neither has a single characteristic Cambrian fossil been found in the last-named series. The marked similarity between the gold-bearing series and the Avalon series, as shown by the following table, points to the probability of the two being one and the same series:—

"*Newfoundland.*	*Nova Scotia*
1. Quartzites, diorites, etc., slate conglomerate and slate.	1. Quartzites, some clay slates.
	2. Greenish-grey, purple, and bluish-grey, slate, the latter with conspicuous banding.
2. Green, red, and purple slates in frequent alternation.	3. Black, with some blue and grey slates, very rusty weathering."
3. Dark brown or blackish slates.	

Matthew thus shows that the gold-bearing series is probably Pre-Cambrian. Then from a lithological comparison with certain grits and slates found in southern New Brunswick, in eastern St. John county, western Kings, and southwestern Charlotte, which have been classed as lower Huronian and marked "A-B" on the map published by the Geological Survey, he concludes that the gold-bearing series is also lower Huronian. The coarser condition of the grits in New Brunswick, and the presence of conglomerates he explains as probably due to the proximity of an emerged area of granite rocks. The thickness of the New Brunswick series, however, is given as 10,000 feet, as compared with the 30,500 feet given by Faribault and 28,000 feet given by Prest.[2]

In a recent discussion of the subject Woodman[3], through a consideration of "(1) unconformities and the composition of younger rocks, (2) structure, and (3) accompanying igneous rocks," arrives at the conclusion that the series is probably Pre-Cambrian.

[1] Trans. Royal Soc. Can., Third Series, Vol. II, Sec. IV, p. 125.
[2] Ann. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 83.
[3] Bull. Geol. Soc. America, Vol. 19, p. 99.

In 1891 Faribault visited the Little Ditton gold district of the Eastern Townships of Quebec for the purpose of comparing the lower Cambrian rocks of that region with those in question in Nova Scotia, and formed the opinion that the two are probably of the same age. The little Ditton rocks are divisible into two groups, a lower, quartzite, and an upper, graphitic, ferruginous slate group as in the eastern province; another noticeable similarity is the occurrence of numerous quartz-veins along the anticlinal axes.[1] Selwyn concurs with Faribault in these views.[2]

It is evident from the above considerations that there is still room for doubt. It seems improbable that sufficient data for the solution of the problem will be obtained, as some have supposed, by a complete systematic survey of the whole gold-bearing series. A large part of the area in which this series is exposed has been mapped by Faribault and Bailey, and some considerable work has been done in that district lying immediately to the south of the Annapolis-Cornwallis valley where this series is found in contact with rocks that are fossiliferous.

Bailey[3] failed to find any distinct break between the non-fossiliferous slates and quartzites of the series in question, and the associated fossiliferous slates and quartzite of Bear river carrying organic remains, some of which have a decided lower Devonian or Oriskany aspect, while others appear to belong to a somewhat lower horizon.[4]

In a study of that area lying south of a line stretching from Wolfville to Kentville in Kings county, and west as far as the Aylesford road, Faribault has shown that with the exception of the small body of the Niagara series of New Canaan nearly all the rocks are of the gold-bearing series. The slates are very similar to those of the gold-bearing series in other parts of the Province, and the quartzite which is exposed along some of the anticlines is the same as the whin of the Goldenville formation. These rocks have been subjected to the same close folding, and the main anticline was traced southwest to the granite. The most westerly of these folds extends southwest from Kentville, plunging to the east and bringing up the Goldenville formation in a broad zone extending from Tupper lake to the granite. All the rocks of this region have also suffered from the same northwest and southeast faulting as the

[1] Summary Report, Geol. Sur., Can., 1891, p. 55.
[2] Summary Report, Geol. Sur., Can., 1891, p. 55.
[3] Ann. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 83.
[4] Am. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 115.

series in other parts of the Province. Careful work in this part of the field failed to reveal any unconformity between the slates of this gold-bearing series and the fawn slates near Kentville in which *Dictyonema Websteri* was found. Owing to the great amount of drift encountered, however, the possibility of an unconformity was not wholly eliminated. Even if the two series of slates are found to be conformable, the age of the gold-bearing series still remains in doubt, as the age of the *Dictyonema* bearing slates has not been determined to the satisfaction of all.

Thus the problem still remains to be solved. Although the term Cambrian has been provisionally applied for a number of years to the series, the weight of evidence seems to point to an earlier origin, and it is quite possible that the series is Pre-Cambrian.

Lower Carboniferous.

Small patches of sediments of this age are scattered along the coast from Margaret bay to Mahone bay. They consist of beds of limestone, sandstone, and shale lying unconformably on the gold-bearing series, and the granite. As much of this area is buried under pleistocene deposits, the exact boundaries of many of the patches cannot be determined. In some places, as at Indian point, the limestone was quarried for lime a number of years ago. At Chester Basin some small deposits of mineral pigments found resting on the limestone once received some attention. Shell limestone was observed on Goat, Sheep, and Stephen islands, and on Second peninsula, and gypsum on the southwest shore of Goat island.

Numerous circular funnel-shaped sink-holes as much as 50 feet in diameter and 20 feet deep, are found in the drift in this locality, and these may indicate a wider distribution of gypsum than is suspected. These may have had their origin in the solution of underlying deposits of gypsum, since holes of this nature are common in districts where gypsum is known to exist.

It is improbable that commercial deposits of coal will be found here. It is reported that bits of bituminous coal were found at the Barkhouse mill and at The Narrows, and a few prospect pits were sunk 20 to 60 feet at these places without reaching bed-rock.

The relation of these strata to those of the gold-bearing series is that of an unconformity. Although the strata are not horizontal at all places, they do not dip at such high angles as those of the

older series. At a contact exposed at the head of Frail cove the basal beds of the lower Carboniferous rocks can be seen lying unconformably on the gold-bearing series, and enclosing angular fragments of the latter, little or not at all worn by wave action.

Basic Intrusives.

Intrusions of a basic nature taking the form of dykes and sills are to be found cutting the gold-bearing series, but they are limited in their distribution almost wholly to the western part of the fields. In the Tangier gold district east of Halifax a dyke 40 feet wide cuts the strata at right angles, and there is a small one on Devil island at the mouth of Halifax harbour. Selwyn[1] speaks of a dyke 150 yards wide cutting the beds nearly at right angles at Cranberry head near Yarmouth, and Bailey[2] mentions one 100 feet thick on Bear river. Gilpin[3] speaks of bedded intrusions in Lunenburg. In the gold-bearing rocks of Kings county such intrusions are very numerous, and vary in thickness from a few inches to 100 feet or more. They nearly all lie in the bedding planes of highly inclined strata, and have altered the slate for a few inches on each side.

All these igneous rocks have received the field name diorite. Those of Kings county are dark-greenish and crystalline and seem to have undergone much alteration. All of them have a strong argillaceous odour and many are noticeably schistose. A microscopic examination of some of the less altered shows that they are fairly fine-grained, holocrystalline, hypidiomorphic rocks with an ophitic texture. There seems to be a large development of hornblende crystals cut by laths of feldspar. They are probably much altered intrusions of diabase.

Little seems to be known regarding the age of these intrusions, but that they are of remote age seems probable from the great degree of alteration they have undergone. Those of Kings county are affected by the northwest and southeast faults crossing the gold-bearing series.

Granite.

DISTRIBUTION.

The granite is widely distributed throughout the gold-fields. It consists of masses varying greatly in size. The most of those east

[1] Geol. Sur., Can., Report of Progress, 1870-71, p. 271.
[2] Ann. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 81.
[3] Trans. North of England Inst. Min. Eng., Vol. XXXI. 1882.

of Halifax do not exceed 10 miles in width or 40 miles in length, but they are very numerous, especially at the eastern end of Guysborough county. To the west of Halifax lies a crescent-shaped mass 95 miles long and averaging 20 miles wide, extending westward into Yarmouth and Digby counties, and northward nearly to the Cornwallis-Annapolis valley, the concave part of the crescent facing south. In addition to this, other and smaller masses occur in the southwest of the Province, in Queens, Shelburne, and Yarmouth counties.

LITHOLOGICAL CHARACTERS.

The composition and texture of the granite vary much with the locality and mode of occurrence. Sir William Dawson in his "Acadian Geology" describes it as sometimes porphyritic and composed of white or smoky quartz, of white or more rarely, flesh-coloured feldspar, and grey or black mica; while Dr. D. Honeyman says that they are generally coarse and composed of white orthoclase, hyaline to smoky quartz and black or grey mica.[1] He also states that the rock is largely porphyritic. Faribault, in his report on the eastern counties, says that the granite varies much in texture and composition according to the position. It is composed of white or pink feldspar, white, colourless, or smoky quartz, and white, silvery mica, all forming a uniform fine-grained mass, becoming porphyritic towards the centre of the mass and carrying phenocrysts half an inch to an inch and a half long.[2] The same writer describes the granite west of Halifax as generally coarse and porphyritic, but often finely crystalline. G. A. Young, in describing the rocks in the neighbourhood of New Ross, Lunenburg county, says, "The light-coloured muscovite granite with which the cassiterite-bearing pegmatite is associated, was seen at a number of points in the neighbourhood, and appears to be cutting a coarse-grained biotite granite like the variety that throughout the eastern portion of Nova Scotia penetrates the gold-bearing sedimentary series. The more common biotite granite is usually rich in the dark mica, and frequently is porphyritic with large crystals of feldspar often an inch in length.

"In the neighbourhood of New Ross, various pegmatitic bodies, areas of fluorite-bearing granite, etc., have been reported, and are

[1] Honeyman, D. Nova Scotian Geol.—Halifax and Colchester counties. Trans. N.S. Inst. Sc., Vol. VI, p. 52.
[2] Faribault, E. R. Ann. Rep. Geol. Sur., Can., Vol. II, Part P, p. 132.

possibly connected with the muscovite granite." . . . Gesner as early as 1849 suggested that the granite is of at least two different ages, for he mentions that some he examined contained masses of older granite which are readily distinguished by a difference of colour.[1] Woodman is also of the opinion that the granites are not all of the same age.[2] Thus the different types of granite may be accounted for in some cases by their relative nearness to the intruded rocks and in others by the probability that there were different ages of intrusion.

The sediments adjacent to the granite are cut by numerous dykes which vary greatly in composition and texture; in composition they grade from the regular biotite granite through pegmatites devoid of the ferro-magnesian minerals to veins of pure quartz,[3] the three varieties being found sometimes in one and the same tongue; in texture they vary from massive quartz to aphanitic aplite or coarsely crystalline pegmatite. These dykes generally follow the bedding planes of the intruded rocks, but frequently cut across them. Good examples of the coarse grained dykes are to be seen in Guysborough county, crossing the Whitehaven road a quarter of a mile south of its junction with the Canso road. The north fork of a mass of granite extending west from Country Harbour river a little below Fenton brook narrows into a pegmatitic dyke forty yards wide; in this the quartz and feldspar often exceed the size of a man's head and some mica scales are found over 6 inches in diameter. Dykes passing into quartz veins are to be seen crossing the Whitehaven road, Guysborough, and at Cochrane Hill narrow intrusions are numerous, which frequently are very fine-grained, carry little mica, and pass into what has been described as quartz-felsite.[4] In addition to these tongues, forced into the sediments, the granite itself contains dykes, apparently quartz porphyries, probably the result of magmatic differentiation, and numerous irregular bodies of pegmatite which probably represent final stages of solidification. In some of these are to be found very good specimens of graphic granite and plumose mica, and in some, as at New Ross, a great variety of minerals characteristic of pneumatolitic action.[5]

[1] Gesner 'Industrial Resources of Nova Scotia,' 1849.
[2] Woodman, J. E. American Geologist, XXXIII, July, 1904.
[3] Faribault, E. R. Ann. Rep. Geol. Sur., Can., Vol. II, Part P.
[4] Faribault, E. R. Rep. Geol. Sur., Can., Vol. II, Part P.
[5] Faribault, E. R. Summary Report, Geol. Sur., Can., 1907, p. 82.

STRUCTURAL RELATIONS.

Internal.—Owing to few mineral deposits being found in the granite not a great deal of attention has been given to the study of this rock. We know that there are at least two different kinds of granite, a muscovite, and a porphyritic biotite granite, and the opinion is held by some that there were two or more intrusions. No volcanic phase is to be found. The nature and extent of magmatic differentiation has not been determined.

External.—The granite is intrusive in the gold-bearing series. Some of the earlier writers considered it of greater age, and Hind maintained that it consisted of altered Laurentian sediments, but the following unmistakable evidence shows that they were in error: (1) The granite contains numerous inclusions of the sediments more or less altered; (2) innumerable dykes of granite penetrate the slate and quartzite; (3) in the vicinity of the granite the clastic rocks have been metamorphosed into gneisses, mica schists, staurolite and andalusite schists, and knotted phyllites, the degree of metamorphism being greatest in close proximity to the granite and becoming gradually less with distance; (4) nothing in the nature of a basal conglomerate is found to indicate that the sediments were deposited on the granite; (5) anticlinal and synclinal folds can be traced to the granite and their continuation found beyond it, and in some places slate is found to lie adjacent to the igneous mass and in others quartzite.

The Nictaux-Torbrook rocks of Annapolis county also give unmistakable evidence of having been intruded and metamorphosed by the granite.

On the other hand the sandstones and shales of the Horton series of Kings and Hants counties overlie the granite and are in no wise altered by it, in fact the sandstones grade in places into a sort of arkose, the product of a breaking down of the granite.

AGE.

Evidence points to the granitic intrusion having taken place during the Devonian period. The Nictaux-Torbrook rocks have without doubt been affected by the intrusion, and of these Bailey writes, [1]"The conclusion arrived at from the fossils at hand from the Nictaux-Torbrook and Clementsport and Bear River basins, that the beds hold forms referable, some to the Silurian, some to transi-

[1] Ann. Rep. Geol. Sur., Can., Vol. IX. Part M, p. 111.

tional series, and others to a horizon at the base of the Devonian (Eo-Devonian), is in accordance with the stratigraphy of the district." We may then safely date the intrusion as later than the earliest Devonian times. On the other hand, since the Horton series overlies the granite, is not altered by it, and is in part at least derived from it, we have sufficient data for limiting the age of the intrusion to one of the great periods of the earth's history. The Horton series has been referred by some to the late Devonian period and by others to the lower Carboniferous.[1] It is, therefore, evident that the granitic intrusion took place during Devonian times. The number of such intrusions and the duration of time over which they extended is not known.

Metamorphic Rocks.

DISTRIBUTION.

Crystalline schists and gneisses are found rather widely distributed throughout the gold-fields, but of limited area. They usually occur in a more or less continuous zone surrounding the granite masses, but they are also found in zones or irregular patches several miles distant from any present outcropping of granite. Good exposures of the metamorphic rock at or near the granite contact can be seen at Cochrane Hill, Guysborough county, on the Halifax and Southwestern railway a few miles west of Halifax, along the Dominion Atlantic railway west of Uniacke lake, on Port Joli harbour, and numerous other places. Exposures of metamorphic rock more remote from contact occur at the extreme ends of the field. [2]At Whitehaven, Guysborough county, between Marshall cove and Wash brook, are two zones a fourth of a mile wide extending to the southwest in the same direction as the folding and appearing to lie in two synclinal troughs. They occur also on the west side of Port Latour harbour, on the west side of Pubnico harbour, and in and about Yarmouth city and harbour.

LITHOLOGICAL CHARACTERS.

The rocks consist of gneisses and schists of various kinds. The gneisses are foliated, consist chiefly of quartz and mica, and are usually lacking in feldspar. The schists are micaceous, and in some of them there is a marked development of staurolite or

[1] L. M. Lambe, Geol. Sur., Can., Memoir No. 3.
[2] Ann. Rep. Geol. Sur., Can., Vol. II, Part P, p. 149.

andalusite crystals, or both. The gneiss associated with beds mica schist is sometimes found to[1] "graduate upwards into a series of beds which, while more slaty, have usually an aspect of much greater coarseness and roughness. This appearance is almost wholly due to the development in the beds of vast numbers of staurolite crystals associated not unfrequently with crystals of andalusite and less commonly of garnet. The staurolite crystals are often quite perfect and usually easily separable from the mass of the rock. The andalusites, on the other hand, are but imperfectly formed, not separated from the matrix, and like the latter, often studded with prismatic hexagonal scales of black mica. The garnets, though well formed and clear, are generally minute." Occasionally twin crystals of staurolite occur. The andalusite crystals, which often occur in stellar groups, are pearly, often pale pink, slender, and prismatic, sometimes 2 or 3 inches long. A great deal of white mica enters into the composition of some of the schists giving the rock a whitish, somewhat pearly appearance; throughout it are innumerable small knots almost black in colour, but without any crystalline form distinguishable in the hand specimen.

In addition to these are rocks that have not undergone so great a degree of alteration, and that are more of the nature of phyllites. Some of these are nearly black in colour, and have a wavy cleavage with a silky lustre. Scattered through these are a great many small black dots that probably represent incipient crystallization.

Some of these metamorphic rocks are highly charged with pyrite.

Faribault describes the rocks at Whitehaven as glistening, pearly, and full of stout, short crystals of andalusite. [2] On McNutt island the quartzites are overlain by and graduate into mica-schists studded with staurolite and andalusite. Some layers are filled with sheafs of hornblende. At Crow-neck point, south of Upper Port Latour settlement, are schists studded with crystals and "semi-crystalline nodules of andalusite," many of which are themselves studded with staurolite, and the weathered surface has the appearance of a coarse conglomerate. Some portions of the rock are a true conglomerate. Some parts also are spotted with dark green blotches with no very definite outline. [3] At the head of Pubnico

[1] Ann. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 54.
[2] Ann. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 57.
[3] Ann. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 68.

harbour some andalusite schists are found to enclose numerous well defined pebbles, mostly of quartzite, so that the original rock was a conglomerate. These rocks are considered by Bailey as important in helping to correlate the metamorphic rocks of Yarmo

The altered rocks about the town of Yarmouth were descr by Dawson in "Acadian Geology," and later and in greater d by Selwyn in the Geological Survey Report of Progress 1870-71, p. 271. Bailey says, "the belt, having a width of about seven miles and a length of about forty miles, may be described as consisting of highly metamorphosed strata in which the abundance of mica, and especially of hornblende, are the most char. .istic features. Chlorite and epidote also characterize some of the beds, but are much less conspicuous, and in some instances the strata are either feldspathic or quartzose. Good exposures are seen about Cape Fourchu. Some "highly micaceous strata (which also contain numerous scattered sheafs of hornblende and are in part true hornblende schists), are also to a large extent conglomerates, being filled with numerous pebbles, sometimes as much as a foot in diameter." These pebbles consist of quartzite in some beds and in others of a grey or purplish-grey vesicular rock, and are flattened and elongated in the direction of the leavage.

These hornblendic rocks can be traced northeast from Yarmouth past Hebron, Wellington, and Ohio. Similar beds occur in the vicinity of Lake George and about Little and Great Brazil lakes and Lake Annis, but here the hornblende is not so well developed, and staurolite and garnet crystals are abundant.

STRUCTURAL RELATIONS.

In these metamorphic rocks there is every gradation from unaltered slates and quartzites to completely recrystallized schists and gneisses, and this feature is especially noticeable in those zones surrounding the granite masses. There the rocks are most highly altered near the granite masses and gradually merge with distance into unaltered slate and quartzite. In some places beds of quartzite alternate with beds of mica schist. Quartzites are found to pass by the development of a foliated character into a sort of gneiss composed chiefly of quartz and mica.

MODE OF ORIGIN.

There seems to be no doubt that the most of these were produced by contact of the gold-bearing series with the granite intrusion.

There seems no better way of explaining the difficulty of drawing a line of demarcation between the intruded rocks and the intrusive, or of explaining the gradual decrease of metamorphism with distance from the granite, or of the final merging of the altered rocks into the unaltered slate and quartzite. The quartzite, being more resistant to metamorphosing agencies, has simply become more micaceous, while the slate under the same influences has been well altered, with the result that the metamorphosed parts of the Goldenville formation consist of alternate beds of quartzite and mica schists or of mica gneiss and mica schists. The metamorphosed parts of the Halifax formation consist of schists and phyllites, the degree of alteration depending on the nearness to the granite mass. Many, if not all, of the patches of metamorphic rock found at a distance from any known granite exposure are also probably due to the contact action of underlying masses or of intrusions into higher levels which have since been removed by erosion.

AGE AND CORRELATION.

If the metamorphism is due to contact action, as is generally believed, it was effected during the Devonian period, as this was the time of the granite intrusion.

The altered rocks at Yarmouth have received some special study and[1] it has been suggested that they are possibly older than the gold-bearing series. Bailey, however, after a close examination, thinks they too are but altered portions of the gold-bearing series. In their conglomeritic character as well as their general aspect they resemble the schists formed from the gold-bearing series at the head and along the western side of Pubnico harbour, but differ from them in the abundance of hornblende and general absence of staurolite and andalusite crystals so common in the Pubnico rocks. However, there is a development of staurolite and garnet in their eastward extension, while there is a limited development of hornblende in rocks of the gold-bearing series on the east side of Shelburne harbour in connexion with staurolitic strata. [2]He concludes, therefore, that the Yarmouth rocks are only altered portions of the gold-bearing series, and the supposed stratigraphy of the region is in accord with this view.

[1] Selwyn, A. R. C. Report of Progress, Geol. Sur., Can., 1870-71, p. 271
[2] Ann. Rep. Geol. Sur., Can., Vol. IX, Part M, p. 69.

Pleistocene.

It has been pointed out that the gold-fields were subjected to glaciation, and that a great deal of rock was laid bare by glacial erosion. Deposition also took place, but to greater extent in the west than in the east, and boulder clay, sand, and gravel, moraines, drumlins, and kames are common.

[1]W. H. Prest, after a study of some of the shallower deposits of Central Lunenburg, has reached the conclusion that there were three glacial epochs in this part of the Province.

Post-Glacial.

Since glacial times the surface has been subjected to sub-aerial erosion, and the regolith has suffered some rearrangement with a little deposition in the valleys and on the submarine continental shelf. The small amount of loose material left by the glaciers has, however, been well protected by the forest growth, and although in recent years the forests are being cut down, so little of the region is arable that the vegetable mantle is seldom completely removed. Peat bogs have formed or are in process of formation in various parts of the Province, and infusorial earth in some of the lakes. The meadows, low-lying stretches found along some of the streams, covered by water during a part of the year and producing a rich growth of grass, probably have their origin in the redistribution of glacial drift. The sand dunes of the west are post-Glacial, and the salt marshes, mud flats, spits, bars, hooks, and loops so common between Jeddore and Halifax are formed by the resorting and redistribution of loose surface material in recent times.

Another feature of interest is the formation of ridges of gravel and boulders about the shores of the lakes. These are in some cases 3 or 4 feet high, and are formed by ice expansion during the winter. The ice along the shore freezes fast to the loose rock, and as it shoves upon the shore, it carries with it the pebbles and boulders, and deposits them. Some of the larger boulders in being pushed shoreward were used by the ice mass to cut quite noticeable channels in the debris, and such channels 10 feet in length are quite common.

---

[1] Trans. N.S. Inst. Sc., Vol. IX, p. 156.

HISTORICAL GEOLOGY.

An attempt may be made to construct a history of the events that have affected the gold-fields.

There was a deposition of terrigenous matter on a sea-bottom that continued a slow subsidence until sediments were accumulated to a thickness of between 5 and 6 miles. The sediments laid down during the first half of the great period of deposition consisted chiefly of psammites (sands) with occasional interruptions of pelites (fine material such as mud and clay), and a very subordinate amount of psephites (gravels.) These are the sediments of the Goldenville formation, which consists now of quartzite with interbedded slates. The second half of the period was one of great deposition of pelites.

The variation in the degree of fineness of the sediments of the Goldenville formation may be due to a combination of causes. The following suggest themselves:—

(1) Long periods of abundant or ordinary precipitation alternating with shorter periods of drouth.

(2) A change in the direction or velocity of the shore currents owing to change in the configuration of the coast, climatic changes, or other causes.

(3) Variation in the rate of subsidence.

Following the deposition of the Goldenville sediments was a short period during which a portion of the waters was comparatively clear, permitting the deposition of a very small amount of calcium and magnesium carbonate. Whether this deposit represents the accumulated secretions of low organisms or chemical precipitation is not known. The clearness of the waters may be due to a change in currents or to reduced precipitation for a short time.

Then came a long period during which the pelites of the Halifax formation were laid down. During a portion of this time the waters probably swarmed with organisms of a low type, but the conditions were not favourable to the development of lime-secreting forms.

The location of the early continent is much a matter of conjecture. There are a few facts that point to its location to the southwest of the present peninsula: (1) the conglomerates occur chiefly in the southwest; (2) cross-bedding is more common in

that portion, both in the quartzite and in the more siliceous beds in the slate; (3) the slates in that part are less uniform, and assume greater variety.

There is little evidence of what occurred between the period of deposition and Devonian times. The absence even in the great synclines of any overlying rock of earlier age than the late Silurian indicates an epeirogenic movement, which brought the area above the level of sedimentation. Then came the subsidence of a small portion which received the Silurian and Devonian sediments of Kings and Annapolis counties. This was a period of more or less denudation depending on the degree of elevation. The extent of rock folding before early Devonian times was probably slight, because rocks of this age appear nearly or quite conformable with those of the gold-bearing series, and seem to have suffered the same close folding and faulting. On the other hand the Horton series is found laid down unconformably on the much folded gold-bearing series, and we, therefore, conclude that the latter series was, during Devonian times, subjected to forces which produced great orogenic movements.

There were two main forces of compression that effected the mountain building, the greater producing the long east and west folds, and the less, which was probably contemporaneous with the other, producing the plunging of the anticlines and the formation of the domes. There is no order in the arrangement of these domes, and the plunge is always at a low angle, so the compression that produced the plunging was not nearly so great as that which resulted in the east and west folds, and was possibly quite local in its action.

This period of orogenic movement was an important one in the history of the gold-bearing series, the period in which it acquired its economic value. Under the combined action of the mountain-making forces numberless fissures were opened along the bedding planes, or across the bedding, or in other cases alternately along and across the bedding, and the rocks were fractured permitting the passage of solutions into the fissures. Some think that the solutions carrying the gold came from considerable depths and filled the fissures as they were forming during the long process of folding. The opinion is also held that the quartz and perhaps some of the gold were deposited from ascending thermal solutions, but that the most of the gold and the sulphides were concentrated in the fissures by lateral secretions.

Following the formation of the veins came a time of faulting during which local faults were formed in the domes in addition to the long cross-country faults, having the northwest and southeast direction.

As soon as the rocks were brought by the orogenic movement within the sphere of atmospheric activities denudation began, and the height to which the mountains rose depends not only on the forces that produced the folding, but also on the intensity of the erosion. We have little evidence on these points, but it seems certain that the levelling of the hills had reached an advanced stage before the formation of the lower Carboniferous conglomerates at Gays river.

In Devonian times came a period of extensive igneous activity, during which the batholiths of granite were formed and the marked metamorphism of the intruded rocks effected. No trace of a volcanic phase of this activity has been discovered.

At some time in the history of these rocks, dykes and sills of basic igneous intrusions were formed in the west, the most of which lie along the bedding planes. The age of these has not been determined, but they were formed prior to the production of the great northwest and southeast system of faulting, to which the gold-bearing series was subjected.

After the granite intrusion, the sediments of the Horton series and the lower Carboniferous limestones, shales, and sandstones were deposited. Then came a certain amount of elevation with erosion, resulting probably in peneplanation in Cretaceous times, then another elevation with rejuvenation of the rivers, and finally the incision of the river valleys of the present day.

In Quaternary times there was a period of glaciation during which the regolith was much disturbed and a large proportion of it carried to the sea. The rocks were well exposed and the auriferous quartz veins uncovered. By the redistribution of the surface mantle the drainage was somewhat altered. Since glacial times a negative movement of the land has taken place and is probably in progress to-day. The gold-bearing series extends beneath the sea, and is receiving modern marine sediments. Whether it extends to the edge of the submarine continental shelf is unknown.

The fluctuations that have taken place in these rocks since the great general folding may have led to the production of a few fissures and the formation of new veins, as well as a redistribution of the contents of the old veins.

ECONOMIC GEOLOGY.

GROUPS OF DEPOSITS.

The gold deposits are the only ore deposits of the area that are of any considerable economic importance. These nearly all occur in veins, but a small amount of gold has been recovered from detritus. The deposits at West Gore consist of an auriferous antimony ore and have been worked considerably for their antimony as well as their gold content. A vein of manganese ore consisting of pyrolusite and manganite and occurring in the granite a few miles north of New Ross, Lunenburg, was worked a few years ago, and another was recently discovered in the vicinity. Near Lake Ramsay, also in the vicinity of New Ross, a small amount of cassiterite was recently found in a pegmatite dyke, associated with fluorine and lithium-bearing minerals. Some attention has been paid to the development of argentiferous galena veins at Smithfield 2 miles west of Gleneig, Guysborough, and in the vicinity of Musquodoboit harbour Halifax county. Granite has been quarried quite a little in different localities, and slate has been worked to a small extent. The scheelite deposits discovered in 1908 at Moose river and at Waverley may prove to be very valuable, but as yet their extent is unknown. A few other minerals have been reported and some have been mined more or less; brief notes will be given on these.

As the gold deposits are by far the most important, these will be given first consideration. These are divisible according to their origin, into two classes, primary and secondary, and will be treated under these headings. The primary deposits of Cape Breton Island are distributed through rocks that, though of Pre-Cambrian age, are quite different from those in which the deposits of the mainland are found, and will require separate treatment.

Primary Gold Deposits of the Mainland.

GENERAL CHARACTER AND DISTRIBUTION.

Gold-bearing quartz has been reported as occurring in the granite, but little development has been carried on. It has been reported west of Halifax at Sambro, at Ketch harbour, Pennant harbour, Torrance bay, and Hubley lake. [1]"On the East river, St.

[1] Faribault. Summary Report, Geol. Sur., Can., 1906, p. 148.

Margaret bay, a fourth of a mile below Hubley lake where the Halifax and Southwestern railway crosses the river, a pit was sunk to a depth of 50 feet in the early days of gold discoveries in Nova Scotia on a quartz vein running north and south. It included pyrites and possibly galena, and was supposed to contain gold. A ten-stamp mill was built, but, so far as could be ascertained, not a trace of gold was recovered."

Apart from the doubtful occurrence of quartz veins in the granite, nearly all the primary deposits of gold of the mainland are to be found in the gold-bearing series. Although there are a few important veins that cut across the bedding, the most of the auriferous quartz veins of Nova Scotia are of the interbedded type, that is they are conformable with the layers of the sedimentary rocks in which they occur. As has already been pointed out, they occur chiefly in the beds of slate which are found interstratified with beds of quartzite throughout the whole thickness of the Goldenville formation, and their distribution and their structure are to a great extent the result of dynamic forces to which the enclosing rocks were subjected. The grouping of the veins in great numbers on domes or on the plunge of the anticlines, the crescentic shape of the exposures, the laminated character of many, and the abundance of feeders are all more or less due to the close folding of the rocks.

[1]The groups of veins occur on the domes along the east and west anticlinals, or on the plunging portion of the anticlines. Rarely they are found in the synclinal troughs, as the Hattie belt and North Star lead at Isaac Harbour. On some anticlines there are two or more domes, and there is thus a certain alignment in an east and west direction. A list of the principal anticlines with the districts located on them is given on page 60. Although not such detailed mapping has been done in the southwestern part of the Province, there is plainly an alignment of the domes in the direction of the anticlinal axes, which are more nearly northeast and southwest in this part of the Province than in the eastern part.

It is clear that the auriferous veins are not limited to any particular horizon, but are found at various depths throughout the whole thickness of the Goldenville formation, at points where structural conditions were favourable for the deposition of ore. There is only one horizon that can be traced throughout the series with

[1] Localities in which groups of veins have been exploited are locally known as gold districts.

certainty and that is the boundary between the two formations, and the horizons of the auriferous strata are always referred to this datum plane.

The depths of auriferous veins below this plane for the districts east of Halifax are as follows:—

	Miles.
"Moose River.. .. ..about	3¼
Tangier.. .. .. "	2¾
Fifteenmile Stream and Beaver Dam.. ..	2½
Lawrencetown..	2
Goldenville, Harrigan Cove, Gold Lake, and Forest Hill..	1½
Waverley and Renfrew..	1¼
Mooseland, Killag, Liscomb Mill, Richardson, Lower Isaac Harbour, Wine Harbour, and Montague..	1
Ecum Secum, Middle Isaac Harbour, Cochrane Hill, Lake Catcha, and Oldham..	¾
Salmon River..	½

Caribou at the base of the Slate Group. Stewiacke about three-fourths of a mile above the base of the Slate Group."

The above table shows that auriferous veins may be looked for anywhere throughout the whole thickness of the Goldenville formation, the essential feature being not the location of any particular horizon or horizons, but rather the discovery of domes and plunging anticlines giving the favourable structural conditions. The slate beds themselves are not strictly essential, and veins are frequently found, as at Mount Uniacke, between beds of quartzite.

A few paying veins have been found in the Halifax formation, but these are the exception.

There are not nearly as many gold districts in the western half of the field as in the eastern, and few have proved as productive as those of the east. The Goldenville formation is not so well exposed, and this may be due to two causes: (1) the slates of the west may have been originally thicker than those of the east; (2) the dip of the strata in the west is not at as high an angle as in the east, the folding has not been as close, and consequently the anticlines were not lifted to as great an elevation above the sea-level, so that the agents of disintegration and erosion were not able to carry their

action so deeply into the quartzite. Another and probably the be reason why gold deposits are less numerous in the west is that th folding was so gentle that there was little slipping of the beds up one another, and little cross fracturing, and consequent failure to produce those channels and openings on the anticlines so favourabl for the transmission of solutions and the deposition of vein matte

MINERALOGY.

The gangue of the auriferous veins consists chiefly of qua with calcite and sulphides in subordinate amounts. There are t varieties of quartz, one being white, crystalline, and frequen coarse, the other dark or smoky, sometimes blue, or blackish, gen ally laminated, and of an oily lustre. The calcite is someti magnesian and ferruginous. Among the metallic minerals, pyr and arsenopyrite are much the commonest, but galena, chalcopyri sphalerite, and pyrrhotite also occur. Amongst the sulphides m also be mentioned the auriferous stibnite of West Gore, mined an antimony ore. Hunt reports that molybdenite and stibnite said to have been observed in some localities, and that, at C Harbour narrows, auriferous quartz near a granite intrusion ries small garnets and zircons. [1] A prismatic and massive form black rutile—possibly referable to nigrine or ilmeno-rutile has be identified from the Irving lead at Mooseland. [2] Poole ment "felsite," mica, and chlorite. Scales of mica are found in s of the leads at Forest Hill, Cochrane Hill and Crows Nest. [3] Th veins usually follow the cleavage planes and cut the interbed leads. They are believed to be derived from the granite mas a in no way connected genetically with the interbedded le Quartz mined from one of these at Crows Nest is reported to h yielded some gold. [4] At Lower Seal harbour feldspar is foun some portions of the veins.

Quartz, with hardly an exception, forms by far the largest p portion of the vein filling, but occasionally calcite or one of sulphides is quite abundant. Sometimes druses are found, wh bear crystals of quartz or calcite. At Hammond Plains beds feebly auriferous quartz as much as 20 feet thick have nume ous cavities lined with crystals of calcite, the surfaces of which a

[1] Geol. Sur., Can., Vol. XI, 16 R.
[2] Quart. Jour. Geol. Soc., London, Vol. 36, p. 309.
[3] Faribault. Geol. Sur., Can., XV, 413 A.
[4] T. G. McKenzie, Trans. Min. Soc. N.S., XII, p. 67.

themselves spangled with cubes of pyrites.[1] "At Renfrew, where the strata have evidently slid over one another, crystals of calcareous spar are common, and sometimes form as much of the lead as the rich gold bearing quartz itself."

Woodman's observations at Moose river go to show that the distribution of the pyrite, which occurs in cubes and granular masses, is quite irregular. It occupies no definite central position, but it is found most commonly on the margins of the veins in sheets and most abundantly on the hanging-wall. In some places it protrudes from the wall-rock into the quartz. Arsenopyrite in the veins is erratic in distribution and is massive, except in a few instances. Silliman noticed that at Tangier there was a tendency on the part of the sulphides, perhaps in a majority of cases, to segregate on the foot-wall, while in other cases they were disseminated pretty evenly through the quartz. Arsenopyrite is frequently found, in considerable masses, on the foot-wall, occurring as bunches, often-times of many pounds weight, embedded in blue slate. In some veins, as the iron lead at Montague, it occurs in lenses or nodules on the foot-wall. Rarely pyrite or arsenopyrite forms the complete vein filling; examples of this are the Anderson Mundic lead of Goldenville and another lead 4 or 5 feet thick on the Cobourg area of the same district, composed almost wholly of arsenopyrite. Galena, which is generally very subordinate in amount, is irregularly distributed, although at Moose River it occupies the interior of the lead in both quartz and calcite. Chalcopyrite is distributed sparingly through some of the veins in an irregular manner.

Silver is found in the gold recovered from the Micmac vein of Leipsigate and the Libbey vein of Brookfield, sometimes in such amounts as to reduce the value of the product to $16 an ounce; the gold from interbedded veins runs from $19 to $20 per ounce. Mint returns showed that the 2,239 ounces of gold obtained at Leipsigate in 1905 contained 402 ounces of silver.

The gold occurs not only free and visible and amenable to amalgamation, but also intimately bound up with the sulphides and requiring other methods of treatment for its recovery. In the white, coarsely crystalline quartz it is found in coarse visible particles showing a tendency towards crystallization; while in the bluish, oily quartz of the laminated veins, the structure of which will be described later, it is usually disseminated more finely through the

[1] Hind, Report on the Waverley Gold District, 1869, p. 25.

quartz or is found in plates in a single layer in the middle, or i several layers parallel to the walls or on the margins of the vein It is generally most abundant on the foot-wall. Crystals of go have been found. From Tangier has been obtained a rhomb dodecahedron a third of an inch in diameter with bevelled edg and bright finely striated faces; distorted octahedra have also be found with dull rounded faces. A large number were found the outcropping of the McDonald lead on the Archibald proper at Harrigan Cove, and a few were purchased for the Victor Memorial Museum, Ottawa. Gold is very commonly associat with arsenopyrite and almost invariably with galena, often formi large nuggets. At the surface the weathering of the sulphides h often left a porous rusty mass with free gold taking the form plates, wires, and nuggets. Plates and scales are often found in t adjacent slate, so that the whole belt is sometimes crushed wi profit. On close examination this gold occurring in the slate found generally to be associated with small films of quartz.

[2] Nova Scotia's gold is very fine, as shown by the following tab of analyses made many years ago:—

Locality.	Authority.	Composition.				
		Gold.	Silver.	Copper.	Zinc.	Tota
Mooseland.........	O. C. Marsh........	98·13	1·76	0·05		99·9
Tangier—Field lode..	B. Silliman....	97·25	2·75			100·0
Tangier—Leary lode.......	U. S. Assay Office..	96·60				
Waverley.	H. How............	94·69	4·74	0·39	0·16	99·9
Ovens..	A. Gesner..........	93·06	6·60	0·09		99·7

CHARACTER OF DEPOSITS AND RELATIONS TO COUNTRY ROCK.

Interbedded Veins.—As has already been pointed out, the auri ferous veins are found on the domes, although in some few case as at Upper Seal harbour, they are found on the plunging parts o anticlines remote from domes. In such cases, however, condition favourable for ore deposition have probably been brought about b a change in the angle of plunge. The distribution of the veins o

[1] Marsh, O. C. Am. Jour. Sc., 2nd series, XXXII, p. 397.
[2] Gilpin. Trans. North of England, Inst. Min. Engineers, Vol. 31 ; 169.

any particular dome is intimately related to the rock structure, and complexity is introduced by the unsymmetrical character of the domes. The main axial plane may be inclined from the vertical, the plunge in the two different directions may be widely different, the axis may be curved, subordinate folds may be developed on the limbs parallel with the main fold or radiating from the centre of the dome, or still greater complexity may result from the union of two anticlines.

[1]On sharp, closely folded anticlines, where the planes of bedding on one limb form an angle of less than 40° or 45° with those on the other, the veins are found close to the apex and generally curve over the anticline forming a succession of saddles, similar to the "saddle-reefs" of Victoria, Australia. On broad folds, on the other hand, where the angle formed by the two limbs is over 45°, the veins are found at a greater distance from the axis. As a general rule the veins are most abundant and richest within the limit of curvature of the strata of the fold. At the apex of a fold the strata are horizontal and the dip increases with distance from the apex until it finally becomes uniform, usually at a high angle. It is within this area of increasing dip, that is within the area of curvature of the strata, that the veins are found. This agrees with the statement that on sharp anticlines the veins are close to the folds, for on sharp anticlines the area of curvature of the strata is close to the axes and the strata assume a uniform dip at a short distance from the apex. If one end of a dome is flatter than the other the veins at that end are farther removed from the axis than at the other, and if veins occur on both limbs of a transversely unsymmetrical dome those on the limb with the higher angle of dip will be nearer the axis than those on the limb with the lower dip. In many districts the veins are found on one limb only and then they occur almost invariably on that limb with the highest dip, this generally being the south limb.

The veins have a limited persistence along their strike and in many cases are arranged *en echelon* so that they lie in zones radiating from the centre of the dome and diverging more or less from the major axis according as the fold is broad or narrow. In a symmetrical dome like that of Oldham the outcrops of the veins form almost complete ellipses. Domes are, however, rarely symmetrical.

[1]Faribault. Gold Measures of N.S. and Deep Mining, p. 13.

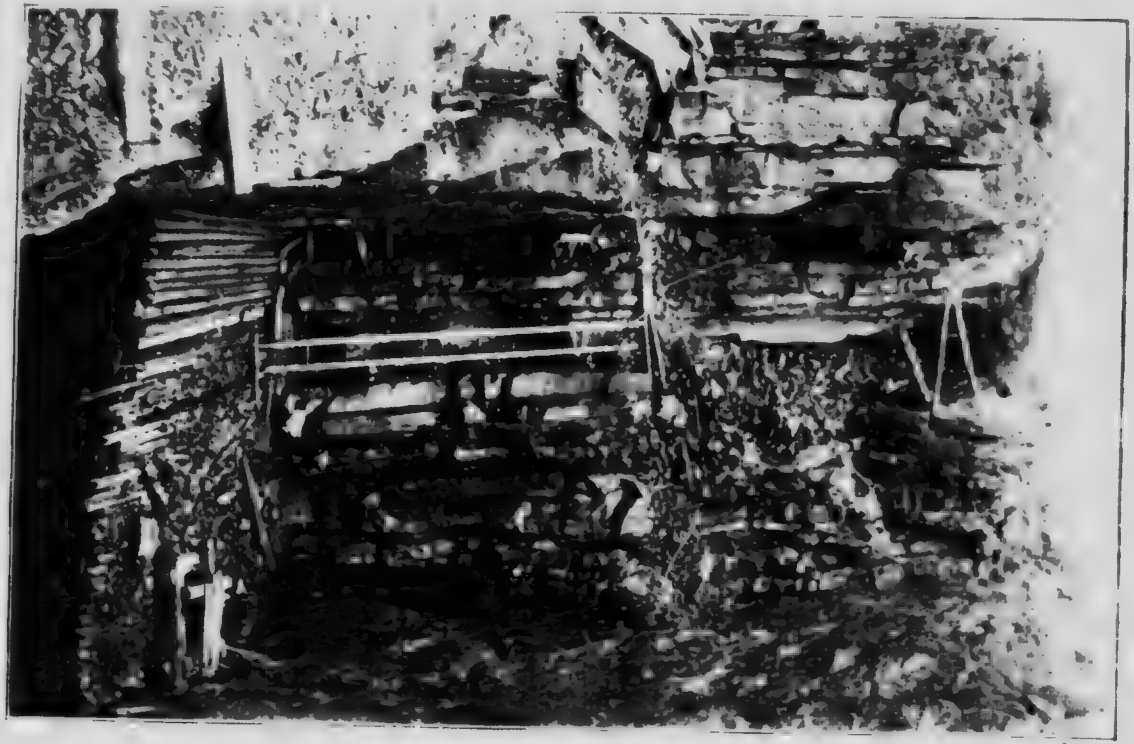
and there are many districts in which veins are found only at one end or on one side of the dome.

In some districts the formation of veins seems to have been dependent on a subordinate flexure on the limb of a fold, producing a curve of shorter radius in the strata than that produced by the main fold. The subordinate folds radiating southward from the dome at Mount Uniacke and southwestward from the dome at Renfrew furnish good examples of this. In some places, as at Mooseland, there is a curving of the main axis of the fold, and in such cases veins (especially those that are auriferous) are found to be much more numerous on the convex side of the axis.

Mining operations have shown that underlying the veins exposed at the surface are other parallel interbedded veins. Each district has thus a vein-bearing zone with a horizontal extent determined by the outcropping veins and with an indefinite vertical extent. In its vertical extension it is believed to be roughly parallel with the axial plane of the anticline. The distance of the exposed veins from the axis depends on the dip of the strata, and it is probable that the distance from the axis of any portion of the zone of veins extending into the earth is also dependent on the dip; if the fold gets sharper with depth, the zone of quartz veins probably approaches the axial plane, or if it flattens with depth as at Salmon river, the zone of auriferous veins recedes from the axial plane.

The interbedded veins have a more or less crescentic outcrop. On the sides of long domes they form nearly straight lines, but they finally curve with the strata towards the apex of the fold, and some have been traced continuously around the end of the dome from one limb to the other. It is not always possible, however, to identify any particular vein found on one limb of a fold with its corresponding vein on the opposite limb. Calculations have been made to determine the exact location of such, but generally without success. It is only when one has traced a vein continuously from one limb to the other that there can be any certainty that the two legs are parts of one and the same saddle. This is what one would naturally expect since the formation of veins is so dependent on dome structure, and symmetrical domes are seldom found. The outcrops of the veins, therefore, generally form only small portions of elliptical curves.

Most of the veins lie in slate beds a few feet wide. Rarely they lie in the middle of the bed, and as a rule only when the bedding is



Open cut showing belt of quartz veins. Worked by the C. P. F. Gold Mining Co., Mount Uniacke.

Serpent lead on crown of anticline, Moose river.

Barrel quartz, Dunbrack lode, Oldham. This shows the cross section of the vein as well as the face of the barrels or corrugations.

marked by some difference in composition or texture, producing planes along which fracturing took place. By far the greater number lie on the foot-wall with only a thin film of crushed slate or gouge separating them from the quartzite. Occasionally, as in the Sterling lead at Oldham, the quartz is "frozen" to the wall. As a rule the veins are quite conformable with the strata, but occasionally they pass from one wall to the other. A saddle-vein, as in the case of the Richardson, may have one leg on the foot-wall and the other on the hanging-wall. If a small crumple occurs on the limb of an anticline the vein may lie on the foot-wall in that part above the crumple and on the hanging-wall in that part below, forming irregularly-shaped veinlets and quartz masses scattered all through the slate belt where it passes from one to the other in the short limb of the crumple. The West lake is a good example of this. Some veins bifurcate, and one portion passes to the hanging-wall, while the other remains on the foot-wall.

Some slate beds are found to carry several quartz veins, generally conformable with the strata. These veins are frequently so small that they could not be profitably separated from the slate, and more or less of the whole body of slate and quartz is milled. These beds of slate with numerous small veins are designated belts, while the well-defined vein is designated a lode or lead. The belt is often 10 or 20 feet wide, and furnishes those large bodies of low grade ore that have in later years been worked with profit. It is sometimes composed of a network of veins, the veinlets following the bedding planes for short distances and then crossing to join other veinlets. They usually pass obliquely upward from a higher to a lower bedding plane and are arr[illegible]ed *en echelon*. There is a strong tendency towards a thicken[illegible] they cross the bedding.

A great many of the interstra[illegible]ns exhibit a folded or corrugated structure. The corrugat[illegible]ns, usually seen at or near the apex of the anticline and sometimes in the syncline, run parallel with one another and in a direction approximately parallel with the anticlinal axis. Where the axis is horizontal the corrugations are nearly horizontal, but where the axis of the dome plunges the corrugations dip in about the same direction and at about the same angles as the plunge of the axis. On the nose of the fold the corrugations dip with the dip of the strata, but on each side of the nose radiate more or less from the centre of the [illegible].

The peculiar corrugated structure of a vein on the apex of the plunging anticline at Waverley attracted attention in the early days of gold mining in the Province, and from its resemblance to a series of casks laid end to end and side by side, the name "barrel" quartz was given. This term is still much in vogue, and is applied to the larger series of corrugations.

The slate beds adjacent to the corrugated veins show a sympathetic folding which extends from a few inches to a foot or so from the vein and gradually dies out. Very rarely is the influence felt in the whin beds, and then only in connexion with the large corrugations on the apex of an anticline.

When some part of a vein becomes enlarged or takes on some peculiarity of form, structure, or mineral content that is traceable for some distance in one direction, or when one of the corrugations becomes enlarged so as to have an individuality of its own, this portion of the vein is called a roll. A roll is frequently richer than other parts of the vein. Its position is usually dependent on some peculiarity of rock structure such as some subordinate crumple, some slight flexure in the beds indicating an incipient crumpling or some zone of fracturing. As crumples, flexures, and fracture zones usually affect a great thickness of strata a number of veins are affected by similar conditions, and a roll on one vein is succeeded by similar rolls on the underlying or overlying veins.

Many of the interbedded veins exhibit a more or less laminated structure through the whole or a part of their length and thickness, and consist of bluish quartz with an oily lustre enclosing several thin films of sl parallel to the wall of the vein. The laminated portions of the veins are usually auriferous. In some veins, as the Barton lead at Tangier, fragments of slate are found embedded in the quartz with trails of smaller pieces leading to that portion of the wall from which the enclosed slate was loosened.

The thickness of the veins that lie in the planes of stratification varies from a fraction of an inch to 24 inches. The greater number may not be much over an inch, but those that have been worked average several inches. An 8 inch vein is regarded as of good size. There are some, of course, that exceed these figures and are as much as 20 feet.

The largest veins are usually found on sharp anticlines. Saddle veins attain their maximum thickness on the apex of the fold and become thinner as they extend downward on the limbs. Thus the

Corrugati··s on the wall in an open cut, Mount Uniacke.

PLATE XIII

Hanging wall of Serpent lead showing corrugations, Moose river.

Richardson vein while 20 feet thick at the apex thinned to 6 feet at the 300 foot level. Some leads have been followed to a depth of several hundred feet with little or no decrease in size, but others have been found to pinch to a mere film of quartz, and it is probable that nearly all of them pinch out at no great depth. The Dominion lead at Waverley was found to decrease from 15 inches on the surface to a mere film of quartz with small lenticular pockets at 500 feet, and to be completely wanting at 600 feet.

Veins are frequently thickened by local disturbances such as a bend, a crumple, or a faulting of the strata. There is also a thickening in that part lying below the line at which an angular enters from above and extending downward to the line from which the angular is given off below. At the top of saddle veins in some districts where the strata are closely folded, the quartz sometimes extends upwards in a large mass where the strata are parted and forms what is known as a rider. A good example is that at the Dufferin mine, Salmon river, where a rider 20 feet thick was worked. In other cases the overlying and underlying rock is much fractured, and the quartz extends from the saddle vein into the fractures forming a reticulated system of veins.

The interbedded veins are quite continuous and many have been traced over a thousand feet in length with little variation in thickness.

The workable belts furnishing many of the bodies of low grade ore are usually over 2 or 3 feet in width, and are often much more than this, the well-known Palmerston belt of Goldenville being 22 feet.

Although leads show a great similarity and are very numerous, some fifty-five different ones being worked or exposed in a width of 1,200 feet on the north side of the dome at Goldenville, and fifty in a width of 500 feet on the south side, yet many of them possess a certain individuality, some peculiarity of colour, structure, lamination, distribution of sulphides, quantity or form of gold, serving to destinguish them from others of the same district. The Vermilion lead at Gold river was named such on account of the boulders traced to it being coloured by oxide of iron, and the Rose lead of Montague received its name from the peculiar colour of the quartz boulders years before the lead itself was discovered.

Cross or Fissure Veins.—A few important veins cut across the strata for a considerable distance, and in some districts, as Brook-

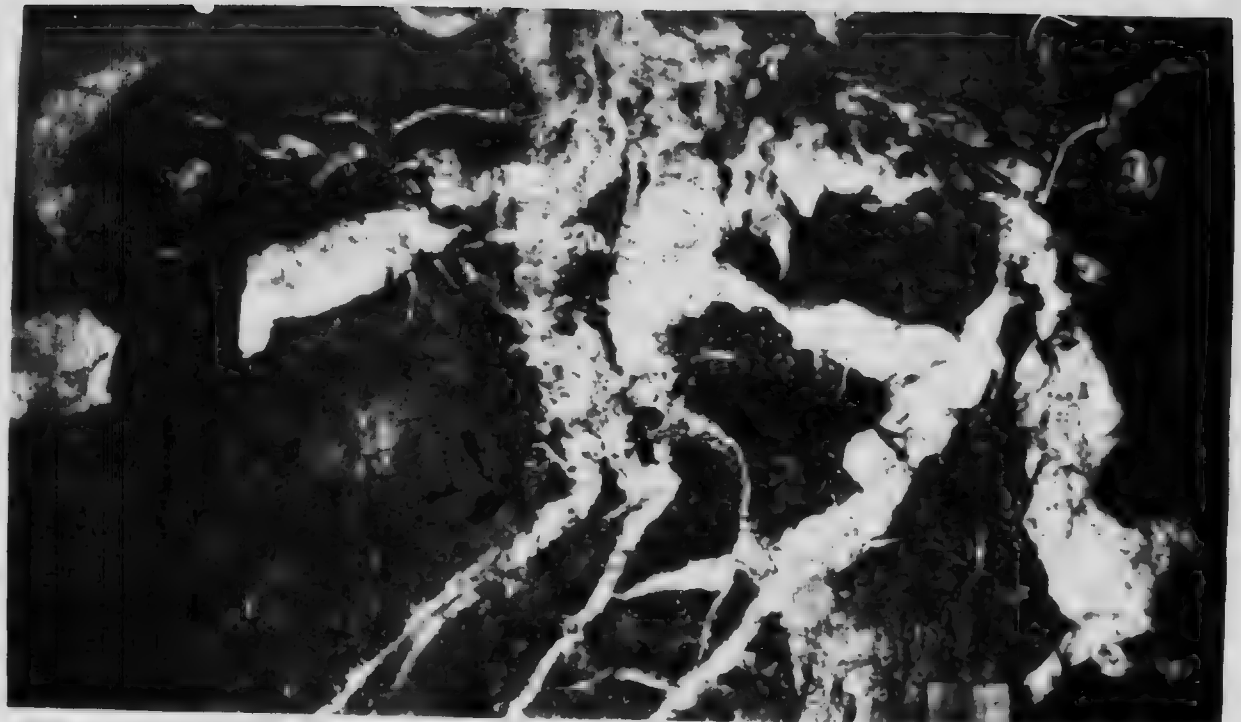
field, Leipsigate, Central Rawdon, and Cow Bay, they form the pr cipal auriferous deposits. These cross veins, frequently spoken as fissures, are usually traceable for some distance in a straight l but some of them, like the Leipsigate, curve and branch. Tw portant fissures, the Libbey and the Leipsigate, dip towards the ax plane and curve towards the end of the dome. Inclusions of th country rock are common. A gouge is found on the walls of th cross veins, but less frequently on the interbedded veins. Seldon does a cross vein lie in a fault plane. Exceptions to this rule ar the Cope lode of Central Rawdon and the Baker vein of Oldham In the former the slickensiding and the curving of the strata or approaching the break show that there has been a movement alon the plane of the break. In the latter the irregularity in thicknes and direction is probably due to a motion along the break as wel as to a difference in the resisting power of the alternate beds o quartzite and slate. The cross veins do not attain a great thick ness except at their intersection with the interstratified leads. Th Libbey vein at Brookfield averages 14 inches, but increases to 15 inches at its intersection with the Mill lead, and the Leipsigat vein, which probably has a length of 9,000 feet, varies from 12 to 5 inches. The mineral content is the same as that of the interbedde veins, but the laminated structure is wanting.

Angulars.—Many of the main veins give off branches passin into the foot-wall and hanging-wall. These branches are terme angulars, and as they play an important part in the ore depositi in certain veins they are carefully studied by the prospector. Th line from which an angular passes from the main vein into th hanging-wall is usually higher than that from which it passes int the foot-wall, and the intervening portion of the vein is frequentl thicker and richer than other portions. These branches were call feeders by the old prospectors, because when they were discovere on the surface in the hanging-wall rock they were taken as indic tions of rich ore where they entered the main vein. On the oth hand those that passed into the foot-wall from the lower limit pay-ore were called robbers. In some places the angular li parallel with but distinct from the vein for some distance befo entering it and becoming incorporated with it. In crossing th bedding it runs nearly perpendicularly across the quartzite, b obliquely through the slate. Some of these erratic veins are foun to pass a short distance into the country rock and lose themselv

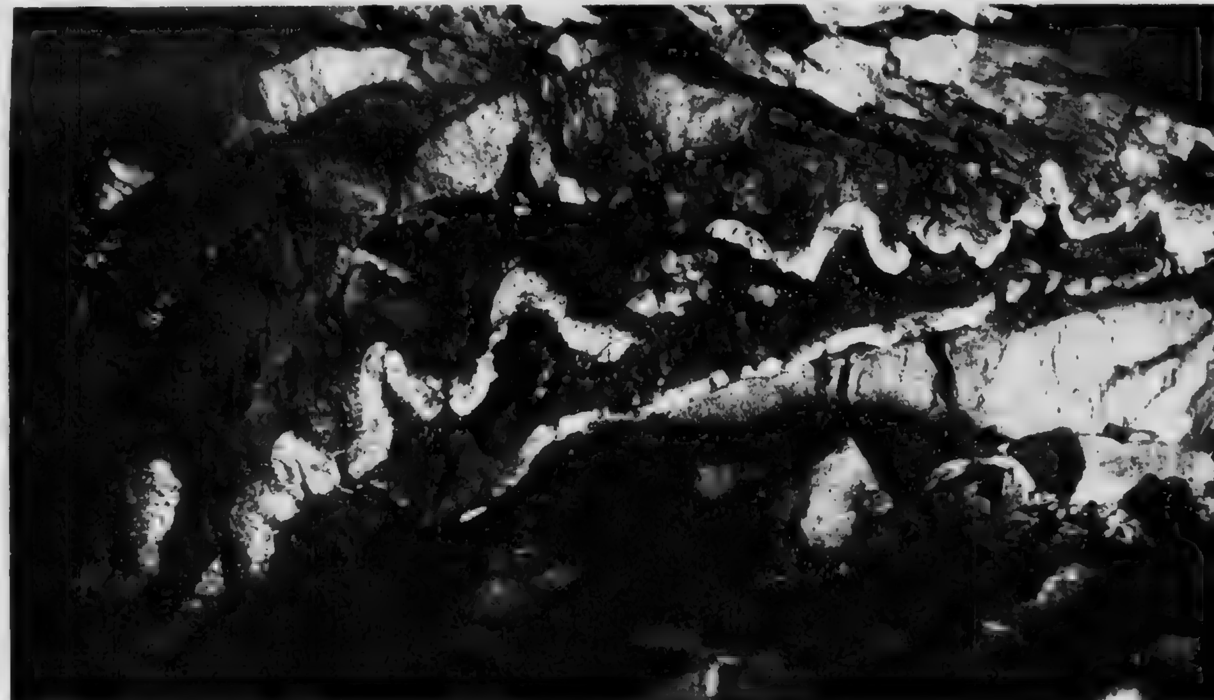
PLATE XIV.

[illegible], Dufferin mine, showing entrance of angulars from the foot wall.

[illegible]



Richardson mine, showing angulars on the foot wall on the apex of the anticline, Upper Seal harbour.



Borden lead, corrugated, and a bull lead on the foot-wall, not corrugated, Mount Uniacke.

in a ramification of veinlets, while others form a network of veinlets crossing the strata from one lode to an overlying or underlying one.

Their distribution on the dome is dependent on the rock structure. In some parts of a dome they may be numerous, occurring in groups and forming a prominent feature in the deposition of ore in the main leads, while other parts of the dome may have been quite unfavourable to their formation. Their attitude is also dependent on the rock structure and in a certain part of a dome they may have a general strike and dip quite different from what is found in another part of the dome.

The mineral content of the angula [illegible] s[illegible]lar to that of the main lead, but the quartz is rather of a [illegible]ular texture and can be distinguished by the miner. It diffe[illegible]s [illegible] from the interbedded vein in being free from laminations.

Bull Veins.—There is another kind of vein differing much from those already described. It may cross the strata or lie in a stratification plane. It shows little or no trace of lamination, carries few metallic minerals, and is composed of white coarsely crystalline quartz in which geodes with quartz crystals are sometimes found. These veins are usually thicker than the others, varying from one to several feet. They are not auriferous and are known as bull veins.

ORE DISTRIBUTION.

The early prospectors and miners were not long in learning that all the veins are not equally auriferous, and they soon found it advisable to turn away from the coarsely crystalline white quartz to those laminated veins of oily quartz carrying sulphides. In a few auriferous veins the gold seems to have had a fairly uniform distribution, but experience has shown that in the most of them there was more or less segregation into pockets or shoots.

Some of the richest ore mined has been found in pockets.[1] In the Blackie lead at Oldham the gold was found aggregated chiefly in nodules of arsenopyrite, and in the Hay lead, lying 1,800 feet north of the anticline of the same district, an isolated pocket carrying[2] 60 ounces of gold was found at the intersection of an angular with the main lead. Further explorations on this lead failed to

[1] Rep. Dept. of Mines. N.S., 1876. p. 55.
[2] Rep. Dept. of Mines, N.S., 1878, p. 26.

reveal more gold. Other large nuggets have been found in such veins as the Annand at Montague and the Dunbrack at Oldham. The West Lake mine furnished ore so rich that one crushing of[1] 13 tons yielded 234 ounces.

The great proportion of the ore, however, lies in shoots having a more or less definite boundary and direction. They vary from 20 to 60 feet or more in breadth, and are frequently accompanied with a thickening of the vein. Many shoots in interstratified veins have been worked to a vertical depth of 300 and 400 feet, and in two cross veins, the Lake lode of Caribou and the Libbey of Brookfield, to a vertical depth of 1,000 feet. That in the Libbey vein was worked throughout a length of 2,000 feet. A shoot in the Hard lead, South Uniacke, was followed 1,200 feet on a dip of 28° east, while that in the Sterling Barrel lead, Oldham, has been worked to a depth of 1,525 feet on the dip varying from 30° to 43°, and in 1909 the ore averaged 2·88 ounces per ton.

As a rule, pay-shoots are composed of the rolls that have been already described, that is of those parts of the veins in which there is some irregularity in size, form, structure, or composition; so that those fractured or contorted parts of the domes or of the flexures on the limbs of the domes that were favourable to the production of rolls were generally favourable to the deposition of gold.

The interbedded leads are frequently found to be very rich at their intersection with angulars as well as in the thickened parts lying between the lines of intersection with angulars from below and from above. In passing, therefore, from an angular into a main lead one usually finds the auriferous portion of the latter in that part which forms an obtuse angle with the angular. All angulars do not enrich the leads they cut and frequently only a set coming from some one particular direction has favoured the enrichment of the leads. The angulars themselves are usually not auriferous, but some have proved gold-bearing, especially in those parts where they cut across slate beds. Those cutting and enriching the St. Patrick and York leads of Montague were themselves found rich and were worked for several feet in the whin foot-wall.

Bull veins are barren, but at[2] Mount Uniacke, where such a vein lies on one side of the Nugget lead and comes in contact

[1] Rep. Dept. of Mines, N.S., 1878, p. 24.
[2] Gilpin. Trans. of North of England Inst. and Min. Eng., Vol. 31, p. 156.

with it at intervals of several feet, the Nugget lead pinches at the points of contact and the bull vein becomes rich enough to warrant crushing.

There is much irregularity in the distribution of the ore in the belts; in some all the veins are auriferous, in some only one, and in others one vein will be auriferous for some depth then become barren, and an adjacent one become auriferous.

That there is some order in the distribution of the shoots was pointed out by [1]Poole as early as 1878. In his report for this year he called attention to the series of shoots on the north side of the dome at Goldenville. The shoots in the Dewar, Middle, and Wellington leads, as well as in the other overlying leads that have been worked, all dip to the west, and the paying ground of each succeeding lead lies to the west of that of the underlying lead to the south, the series of shoots thus forming a line running northwest from the centre of the dome. A study of the plans made by Faribault of the different gold districts reveals a linear arrangement of the outcropping of the pay-shoots in nearly every district. In the case of sharply folded anticlines the line runs roughly parallel with the axis or diverges slightly from it in radiating from the centre of the dome, while in broad folds the line diverges still more from the axis. The shoots dip in the general direction of the plunge of the anticline, and at about the same angle. In some veins two or more parallel shoots have been found. The rich shoot on the Hard lead, South Uniacke, really consists of two streaks lying 40 feet apart; in the Mulgrave lead, Isaac Harbour, a shoot 30 feet broad lay 180 feet below another 12 feet broad, both dipping west at an angle of 12°; and in the No. 1 or Sims lead, East Rawdon, seven pay-shoots dipping east and separated by barren quartz were met in a shaft 510 feet deep.

The distribution of the shoots is frequently dependent on some subordinate flexure or crumple in the strata, and then the direction of the line of shoots and of their dip is usually dependent on the structure of this subordinate fold. For example, the large series of ore bodies worked at Renfrew is due to a subordinate undulation in the strata on the south limb of the dome. So also the rich parts of the West Lake, Nuggety, Little, and Borden leads, Mount Uniacke, were determined by a subordinate crumple affecting all of them. In this regard, each district has its individuality, the struc-

[1] Dept. of Mines, N.S., 1878, p. 26.

ture of one dome never being just the same as that of another. The distribution of the pay-shoots, consequently, is never exactly the same for any two districts.

In cross veins the ore body is found, in some cases at least, to lie at the intersection of the vein with certain strata. At Cow Bay it dips south of the same angle as the strata, and follows certain beds highly charged with pyrrhotite. The shoot, followed 2,000 feet in the Libbey vein, extended from its intersection with the Mill lead on the north to the vicinity of its intersection with the Jim lead on the south.

Pay Zone.—Certain facts point to the existence in most districts of zones extending to a considerable depth in which a succession of auriferous, interbedded, quartz veins of similar character and extent lie superimposed one above the other. On the north limb of the anticline at Goldenville several parallel veins lying close together pass under one another, and each has been worked to some depth beneath the overlying veins. An example of superimposed ore bodies on the apex of the anticline is found at Isaac Harbour on the west side of the harbour where the workings of the Burke lead were carried below those of the Archie, McPherson, and Saddle leads. So also at Mount Uniacke a series of pay-shoots was worked on the West Lake, Nuggety, Little, and Borden leads, where they are affected at successively greater depths by a subordinate crumple with an axial plane dipping north at a high angle.

The observation of these and numerous other similar relations led to the propounding of the pay-zone theory by Mr. Faribault.[1] As has been pointed out, the distribution of the pay-shoots is much dependent on the structure of the anticlinal fold or subordinate flexures on the fold, and they lie in a line passing through similarly curved or twisted portions of the strata that during the folding process were subjected to the same pressures and tensions and were fractured so as to permit the transmission and deposition of minerals. The subordinate flexures and peculiarities of structure, on which the distribution of pay-shoots depends, extend to an unknown depth, and it is claimed that interbedded veins and pay-shoots should succeed one another with depth so long as the structural conditions continue the same as those producing the pay-shoots exposed at the surface. These structural conditions generally extend in depth

[1] Geol. Sur., Can., Vol. V, 57 AA, and Vol. X, 109 A.

parallel to the axial plane of the dome. We thus get a pay zone the surface extent of which coincides with the surface over which the pay-shoots outcrop, and which extends parallel with the axial plane of the dome to an indefinite depth. The fact that gold mining has been carried on to a vertical depth of 1,000 feet in the Province, though in fissure veins, and the analogy existing between the interbedded veins of Nova Scotia and the saddle reefs of Bendigo, where mining has been carried to great depth, may be considered as evidence in favour of the theory.

While the hypothesis may be of general application it is not claimed that it will hold in all particular cases. Structural features vary with depth; subordinate folds may die out and main folds may flatten and thus the pay-zone may die out or be shifted in position with regard to the anticlinal axis. For example, in the case of the Dufferin mine, Salmon river, rich ore was found at the apex of the fold at the surface, but more remote from it in the lower veins owing to the flattening of the dome.

The hypothesis was put to the test at the Bluenose mine, Goldenville, and the results were highly satisfactory. Cross-cuts were made from the Springfield belt towards the axial plane at depths of 280, 364, and 460 feet, and several saddle veins were cut that do not show on the surface. The most important of these, the McNaughton, was worked extensively on the south leg. Parts of the Dunstan and other veins intersected by the cross-cuts were also worked, the auriferous portions of all forming a zone about parallel with the anticlinal axial plane.

In this discussion is involved the whole problem of deep mining. The existence of pay-zones of unknown depths and the analogous character of the Nova Scotian veins and Bendigo reefs, which have been worked successfully to a depth of [1]3,000 feet, and proved auriferous at over 4,000 feet, have led many to think that deep mining could be carried on with profit in our gold-fields.

It is a question whether in the propounding of the pay-zone hypothesis too much emphasis has not been laid on the function of peculiarities of rock structure in the deposition of ore to the neglect of other factors that may have entered into the problem.

[1] The Australian Mining Standard, Nov. 18, 1908. Vol. XL, p. 55[illegible]

GENESIS.

The veins were formed in the openings produced by the movements of the strata. During the folding of the interstratified beds of slate and quartzite, or shale and sandstone, there was a certain amount of slipping of one bed over another. This slipping produced openings along the bedding planes, which were in general widest at the apex of the fold and decreased in width down the limb until at a depth of a few hundred feet they pinched out. During or subsequently to the formation of these openings, which took place within the less resistant beds, the vein filling was introduced by solutions. Thus is explained the dependence of vein distribution on rock structure. The arching of the rocks on closely folded symmetrical domes produced fissures passing over the apex down each limb; on broad domes the arches were not strong enough to sustain themselves and the fissures were formed only on the limbs; on unsymmetrical domes the slipping of the strata was such as to produce fissuring along the bedding planes of the limb with the higher angle of dip; and subordinate flexures in which the strata were given a curve of less radius than ordinary were especially favourable to the production of fissures.

The process of folding was long continued, and the deposition of vein matter probably took place during the process. Small fissures were formed along the bedding planes and filled with quartz, only to be followed by other parallel openings between the quartz sheet and the slate and further precipitation of quartz in the new openings. Films of slate adhering to the quartz forming the wall of the new fissure thus became embedded in the vein. A succession of such events produced the laminated character of the interstratified veins. Another explanation that has been given of the laminations is that quartz was deposited in the slate along a number of parallel planes lying close together in an area of minimum pressure and that the quartz films increased in thickness through a widening of the spaces either by the folding of the strata or by metasomatic replacement.

The origin of the corrugations is more difficult of explanation. That they are dependent on the rock folding is generally conceded, and the following explanation has been suggested. Many veins were formed long before the folding processes were completed and during the subsequent stages they were subjected to the same forces as the rocks. The main forces that produced the folding were horizontal,

and if the horizontal forces be resolved into components perpendicular to and tangent to the bedding plane, the component perpendicular to the bed will be greater on the limb than at or near the apex of the anticline. There will thus be a tendency towards a thinning of the beds on the limbs and a proportionate thickening at and near the apex. This will express itself in a motion of the more plastic beds, that is of the shales or slates, from the limbs towards the apex, resulting in a thickening on the latter, a phenomenon that is frequently observed, especially in closely folded strata. Any quartz veins already formed in such slate will partake of the same lateral motion; on the limbs of the fold where the strata are curved they will suffer little change, but where the strata begin to curve and the slate beds to thicken the veins will begin to fold and become corrugated. On the side of long domes there was but one deforming force that came prominently into play, that which produced the east and west folding, and the corrugations are consequently horizontal and parallel to the axis, but at the plunge of the dome a second force about at right angles to the first expressed itself in the pitching of the dome, the resulting movement was more complex, and corrugations were produced radiating more or less from the centre of the dome.

Origin of Mineral-Laden Solutions.—Three different opinions have been held as to the origin of the solutions by which the fissures were filled: (1) that the minerals were deposited from descending solutions; (2) that they were dissolved out of the country rock; (3) that they were deposited from ascending solutions. Little evidence has been adduced in favour of the first, and the two most generally held are the second and third.

The lateral secretion theory found an exponent in Gilpin,[1] who points to the fact that of the two kinds of country rock the slates alone carry gold of any appreciable amount. He also points out that most of the interbedded veins occur in slate and the richer parts of the fissure veins commonly follow the intersection of the veins with slate beds. He expresses the opinion that "so far as the subject has received attention the slates appear to be the source of the gold. The metal, in common with various metallic compounds, may have been carried and deposited in the layers as they were forming. That which fell in the sand would, presumably, for

[1] Proc. and Trans. Royal Soc. Can., Vol. VI, Sec. IV, p. 63.

the greater part, accumulate in the underlying bed of denser mate-ial, forming the first stage in the concentration now presente. He suggests "that the gradual deposition of gold from current the beds of clay or mud and sand might, through special currents accelerated or specially increased at certain points, and that fr this enriched material the veins derived their 'pay streaks.'"

[1]Woodman expresses the opinion that most of the qu filling the interstratified veins was introduced rapidly by ascend hot solutions, and that possibly a small proportion of the gold a similar origin. Regarding the origin of the sulphides in country rock and in the veins, and the genetic relations exist between the two, there has been insufficient evidence adduced yet reach any final conclusion. But the "method of occurrence of in the veins of this series, its distribution in the country-rock, its relations to sulphides point strongly to the conclusion that least a large part was deposited in the sediments and has been in process of concentration in veins by water which comes down-ward from the surface. It is possible that not all the gold a region of so complicated a history has the same source; but some may have been brought up with the quartz, the facts so observed do not show that more than a small share of it had origin."

These remarks do not apply to the productive cross veins fissure veins, for in these "the structure of the veins and the char-acter and positions of the accompanying minerals point strongly a deep-seated origin for the metal."

Faribault and others are of the opinion that the veins filled by ascending solutions. These found a passage up through the fractured portions of the domes. A fracturing the bedding as well as fissuring along the bedding planes se have been necessary for the formation of veins and ore de veins are not commonly found along straight non-plungi clines although there was, no doubt, a great deal of fissuring alo the bedding planes; on the other hand, where the anticlines pl and the rocks were fractured across the bedding, veins are abund-ant. The cross fractures are themselves filled with quartz form-ing the angulars entering and leaving the interbedded veins. The cross fractures seem, therefore, to have provided channels for the passage of solutions across the beds of quartzite and slate to the

[1] Proc. Boston Soc. Nat. Hist. Vol. 28. No. 15, pp. 391 and 395.

interbedded fissures along which deposition took place. That the solutions entered by way of the angulars is borne out by the fact that the rich portions of interbedded veins are those portions lying between the line of entrance of an angular and the line along which it leaves the main lead.

The source of the ascending solutions is not known, but it is held not to be in the granite or any other known igneous intrusion. Field evidence goes to show that the granite intrusion was possibly later than the formation of the veins. At different places, as Country Harbour and Forest Hill, interbedded veins are cut by dykes of granite, and the proximity of the intrusion appears to have had little or no effect on the size or richness of the veins. Near the outlet of Moose lake in the western end of Mooseland gold district a few auriferous interbedded veins have been traced to the granite, but without increase in size or other irregularity.

[1]Dawson expresses the opinion that the granite intrusion and the formation of the gold veins may have been "roughly contemporaneous." It has been suggested also that, as the cooling and solidification of the granite was long continued, the auriferous veins may have been formed by solutions given off from one portion of the granite mass and afterwards cut by dykes given off from other portions of the mass that were a little later in solidifying. Or it may be that veins were formed from solutions given off by one granitic intrusion and cut by dykes from a somewhat later intrusion.

Further light may be thrown on the problem by a study of those deposits where it is said feldspar forms a part of the gangue as at Lower Seal harbour, or where there are numerous veins carrying mica as at Cochrane Hill, Crowsnest, and Forest Hill. A study of the genetic relations of the interbedded scheelite-bearing veins of Moose River may also be of service in this connexion.

In conclusion it must be said that, while certain field relations indicate that the veins were formed prior to the granite intrusion, the question of the source of the solutions is still open.

Precipitation.—Little study has been given to the cause of the precipitation of the metallic contents of the veins. Certain slate beds apparently exercised a greater precipitating effect than others. These are generally black and are frequently impregnated with

[1] Acadian Geology, Third Edition, Supplement, p. 85.

arsenopyrite, pyrite, or pyrrhotite, and the inter-stratified that can be worked with profit are usually found in beds of character. In some cases the cross veins also are found enriched where they lie in contact with strata of this class.

The question of secondary enrichment has received little and little is known with regard to what extent the fracture zones the districts have afforded means for the passage of meteoric w and a secondary redistribution of the mineral contents of the

Conclusion. Briefly stated, the observed facts seem to be explained on the theory that the veins were formed by the de tion of quartz, sulphides and gold in cross fractures and inter openings occurring chiefly in the black or pyritous slate beds Goldenville formation, that the conditions necessary for the tion of the veins was a deal of fracturing across the planes, permitting the passage of thermal solutions that these fractures were the two horizontal forces manifested the formation of domes plunging of the anticlines.

MINING, MILLING, AND METALLURGY.

Few complete descriptions of the methods of mining, and metallurgy have been written, and this division of the will be of a rather fragmentary nature. In the early days industry the miners and mine managers were chiefly little or no experience in mining matters, and the methods necessarily crude and wasteful. The individual efforts earliest years gave way to concerted action by men of ad areas or to the passing of several contiguous areas into the of a company. Gradually trained managers took charge mines, introduced modern approved methods and up-to-date ery, and during the later years operations have been carri skilfully as in any mining camp and with the most rigid ec

Mining.—Two systems of mining have been in vogue, tem of open-cutting and the system of sinking shafts and The former has been applied in the mining of those larg in which the leads are so small that it would not pay to work individually. The enclosing slate frequently carries a littl and the whole body of the slate and quartz forms a great low-grade ore the most of which is milled. The introduct

modern methods with the resulting economy and the ease of handling a large body of ore, made it possible to mine many of these low-grade belts with profit.

The usual method of underground mining has been to sink inclined shafts on the dip of the lead and follow the ore by means of levels. Frequently a succession of shafts was sunk on the same vein, each successive shaft being deeper or shorter than the preceding, depending on the pitch of the ore body. The sinking ceased on passing through the pay-shoot; although in the early days, before much was known about the distribution of the ore in the veins, much labour was frequently lost in continuing shafts into barren parts of the vein. In some cases the ore has been most economically removed by sinking the shaft on the pitch of the shoot, and the great bulk of the Libbey fissure was reached in this way. The ore in the Lake lead, Caribou, was first removed by an inclined shaft on the pitch of the shoot; afterwards a vertical shaft was sunk, but in 1909 an incline was once more started, this time from the foot of the vertical shaft to reach ore that had been formerly reached by a winze.

The policy in the past was generally to limit operations to the vein on which the shaft was sunk, but with an increase in the knowledge of the structure of the rocks the system of cross-cutting has been adopted in recent years. The necessity of a knowledge of the geological structure was emphasized by some of the earlier investigators, and the detailed work of these and later geologists has given the miners the means of acquiring the necessary information. A study of the structure showed the miners that a few feet of cross-cutting would frequently give access to other veins, and where the cross-cutting was towards the anticlinal axis it would expose veins which were not to be seen at the surface. This has been proved in practice more than once, a good example being the discovery of the McNaughton lead by cross-cuts from the Springfield belt, Goldenville.

In recent years there has been a tendency towards the sinking of vertical shafts to get in touch with a succession of veins, and Faribault points out that in some cases the pay-zone can be most advantageously developed by means of a vertical shaft with cross-cuts and levels, while in other cases inclined shafts following the pay-shoots are to be recommended.

The under-hand system of stoping of the earlier days has to a great extent been replaced by the over-hand system.

The bed of slate carrying the lead is usually from 1 to 4 feet thick, and is soft and easily worked. When the slate bed is thin a bed of quartzite has to be removed also to afford room for the workmen. As the slate is removed the quartz is loosened from the wall by means of the pick and bar, or by blasting, and sometimes, especially where the gold is nuggety, a great deal of slate is removed exposing a large surface of the vein before any ore is broken down. This prevents much of the pilfering of which the Nova Scotian miner has been accused. The whin furnishes smooth and firm walls which often obviate the necessity of much timbering.

The support of the hanging wall becomes a more serious matter in veins that dip at a low angle and resort must be had to more timbering. Pillars of the slate bed are often left as supports, but in some cases, as at the Richardson, Upper Seal Harbour, where too much reliance was placed on the arching of the hanging-wall as a support, it required the lesson of a heavy cave-in to impress the necessity of leaving natural supports or erecting numerous artificial ones where the dip is at a low angle.

One great advantage which the Nova Scotian gold miner possesses is the small amount of water that enters the mines, workings being exceptionally dry in the unfaulted parts of the districts. This is due to the impervious character of the rocks.

Black powder, which was the explosive used in the early years, has given way to the more effective dynamite.

Machine drills of various kinds have also replaced the old system of hand-drilling in those mines where operations are extensive enough to warrant the purchase of the necessary machinery. There was for some time a prejudice against the adoption of machine drills, some claiming that owing to the ease with which the slate is worked it was as economical to drill by hand. The records of the cost of the two methods have shown the economy of the machine drill.[1] From May 1 to November 1, 1897, it cost with hand drilling on an average $2.54 per ton to deliver ore to the mill from the Libbey fissure, Brookfield, a vein averaging not over 18 inches in width of crushing material; while in January, February, and March, 1898, the average cost with machine drills was $2.11

[1] Libbey, W. L. Jour. Min. Soc., N.S., IV, 1898-9, p. 51

per ton. This shows a balance of 10 cents per ton in favour of the machine drills. Besides, with the air plant they were able to do in a given time 25 per cent more sinking and drifting than with hand drilling.

In most of the mining districts, steam-power has been used. In some, water-power has been applied to milling, and in a few, to mining operations, but too frequently, water-power that was capable of being developed in the immediate vicinity or within reasonable transmission distance of the districts has been too much neglected; and nearly every gold district in the Province is within a few miles of such power. The tribute system and the individual efforts of the past have been unfavourable to its development, but concerted action on the part of the mine operators might lead to favourable results.

Under the old system, where the interest in the mine was only temporary and operations were carried on on a small scale, no plans or records of the work were kept, and thus a valuable lot of information was lost; but in recent years the importance of such has been recognized, and plans of the workings are kept.

The cost of extracting the ore will vary with the thickness of the vein. In 1882 Gilpin gave the cost as varying from $15 in narrow veins to $1.50 in veins 3 feet wide or over. [1] A. A. Hayward gives interesting details of the sinking of a shaft of 403 feet at South Uniacke. This was carried out at the average rate of 71 feet 6 inches per month, and at a cost of $11.53 per foot completed and timbered. It was divided into two compartments, each 4 feet by 4 feet inside, and required rock dimensions of 5½ feet by 12 feet. [2] W. L. Libbey gives the cost of sinking an incline shaft and of driving levels. At a depth of 2,000 feet on the incline shaft sinking was done at a cost of $19.25 for a shaft 8 feet by 11 feet, and levels 6 feet by 9 feet were driven at a cost of $8.79 per foot.

Milling.—The early days were days of crude and wasteful machinery. The small stamp mill and the arrastre were used. With the revival of the industry in later years came the introduction of the modern mill of approved design. Various kinds of mills have been experimented with, but the stamp mill is now the only one in use. Concentrators for saving the auriferous sulphides

[1] Rapid sinking in a Nova Scotia Gold Mine. Jour. Min. Soc., N.S., IV, p. 40.
[2] Jour. Min. Soc., N.S., IX, p. 94.

have been used in later years, the Frue vanner being used for a time, but giving way altogether to the Wilfley table.

Metallurgy.—Most of the gold of Nova Scotia is free milling, and can be recovered by amalgamation, but the sulphides also carry the precious metal combined in such a way that the mercury has no effect on it. Silliman, Hunt, and others, drew attention to the amount of gold that was being lost in the tailings, but the early miners, who were generally unskilled men, were content with what they could recover by amalgamation, and made little attempt to grapple with the more difficult metallurgical problems. Some attempt was made to make the ore less refractory by submitting it to a process of calcining, but only a small proportion of the sulphur and arsenic was burned away, and the process was discontinued.

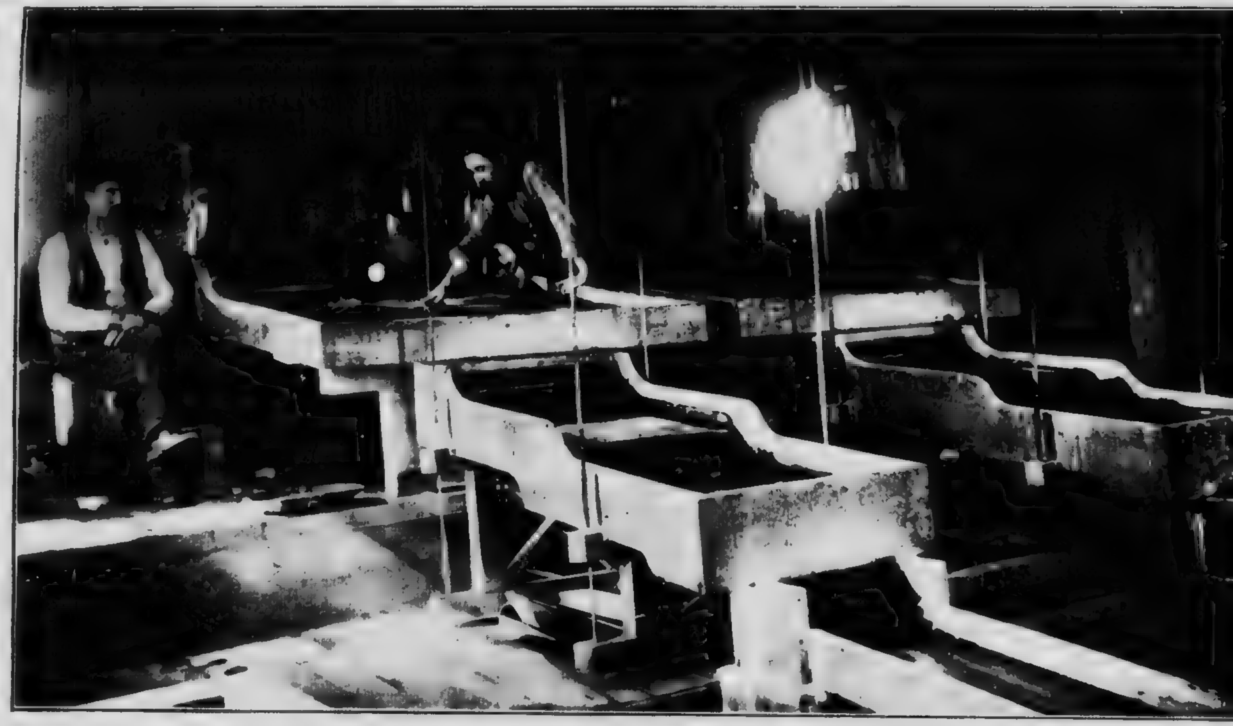
Later on attempts were made to concentrate the tailings, and the concentrates were shipped out of the Province for treatment, but these operations were chiefly of an experimental and desultory nature, and until [1]"the beginning of 1897 it may practically be said that no systematic attempt had been made to obtain anything but free milling gold from the ores of Nova Scotia." About 1881 a chlorination plant was started at Waverley. Of this, Mason writes:[2] "I have examined this plant and have never seen or read anything quite like it. How successful work could ever have been expected from it, is a little difficult to see. It is perfectly evident that those connected with the erection of the plant had not even an elementary knowledge of the business, and failure was the natural result."

Touquoy, at Moose River, treated the concentrates during the nineties by placing them in a pile out of doors, scattering salt on them occasionally, and letting them remain thus for some time. They were then mixed with quartz and milled.

"The early attempts at cyaniding met with a fate similar to those of chlorination."

These early failures had a bad effect on this branch of the industry and led to the opinion that the gold which was not free-milling was not worth trying to save. That the tailings and concentrates carry a very appreciable amount of gold is shown by the following table compiled by Mason from a great number of assays made from different districts.

[1] F. H. Mason in Ores of Nova Scotia, by Gilpin, 1898.
[2] Ores of Nova Scotia, p. 34.



Stamp mill. Dufferin mine, Salmon river.

ASSAYS OF GOLD.

District.	Tailings from Plates.		Tailings from Dumps.		Concentrates.	
	Maximum	Minimum.	Maximum	Minimum.	Maximum	Minimum.
	oz. dwt. gr	oz. dwt. gr.	oz. dwt. gr.	oz. dwt. gr.	oz. dwt. gr.	oz. dwt. gr.
Cow Bay........	0 1 18	0 21				
Sherbrooke.......	0 3 12	0 21	0 6 10	3 6	1 8 0	1 8 0
Caribou.........	0 2 22	0 14	0 13 2	2 23*	12 0 20	0 2 22
Uniacke..........	0 8 4	0 21			15 3 3	1 17 21
Stormont.........	0 15 8	0 1 18**	0 16 22	3 6	15 1 19*	1 7 0
Brookfield.......			0 13 1	14	12 17 0	1 3 0
Waverley.........	0 2 15	0 21	0 6 12		4 14 1	1 8 7
Central Rawdon..	0 2 22	traces	0 14 17	4 16	5 15 0	1 2 4
Wine Harbour..	0 3 12	0 1 0	0 6 17	3 12		
Tangier..........	0 1 4	0 21				
Fifteenmile Stream......	0 13 10*	0 7	0 19 20	7		
Oldham..........					3 8 0	1 8 4
Gold River.......			7 12 20*			
Lunenburg co.....					99 16 18*	21 1 8*
Montague	8 2 8***	0 1 4	0 7 0		7 11 16	5 9 16

* Contained amalgam in appreciable quantities.
** The ore was [illegible] only $2 in free milling at time the tailings were taken.
*** Tailings from ore containing upwards of 40 per cent mispickel.

Late in the nineties, miners again directed their attention to the treatment of the refractory ores. At Brookfield, a chlorination plant was erected and the ore was successfully treated for a number . years. The process was apparently not as satisfactory as could be desired, for in 1904 it was replaced by a bromo-cyanide plant.

A cyanide plant at the Micmac mine, Leipsigate, was completed in February, 1903, and has been successful in the treatment of the tailings from the mill plates, as well as the old beds. H. S. Badger who was in charge furnishes the following interesting information:—

(1.) The ore carried gold to the value of $10.58 per ton, but by amalgamation the best recovery was $7.08. Of 5,104 tons of stock treated by the cyanide process an extraction of 74·9 per cent

of the gold was effected equalling \$2.83 per ton. The total cost of treating the stock was \$1.05 per ton.

In 1902 we find the tailings from the Richardson mine being treated without concentration by the Stuyvesant cyanide plant which was moved from Caribou where old tailings were treated a short time in the autumn of 1901, but later in the year the cyanide plant was shut down, the gold being too small in amount to be remunerative, and tests were made with the bromo-cyanide process.[1] In 1905 a Wilfley concentrator was put in and a simple bromo-cyanide plant of about 20 tons capacity was erected at a cost of \$1,000. It is capable of treating the concentrate from 60 stamps, the ore carrying 2 to 3 per cent of concentrates. The method of treatment is based on the Sulman-Teed process, except that the ordinary zinc box precipitation is used. After cyanide treatment the tailings which still carried 40 to 50 per cent of gangue were reconcentrated and shipped to Germany, and later to Swansea. They contain 39 to 40 per cent arsenic and some gold.

[2]Below is given an abstract from the monthly statement for August, 1906.

"No of tons crushed..	3,939
No. of tons concentrates produced..	82·72
Value of ore per ton (determined by assay)..	\$2.94
Value of concentrates per ton..	17.00
Total value recovered..	2.55
Cost of operation of mine per ton.. ..	1.08
Cost of operation of mill per ton..	0.19
Cost of operation of cyaniding plant per ton ore..	0.10
Cost of cyaniding concentrates, per ton concentrates..	4.39
General maintenance of plant..	0.53
Total cost of operation per ton..	1.90
Average crushing per stamp per hour..	2·98 tons."

So impressed is the mining community with the importance of recovering all the gold possible, that nearly all the larger plants that have been erected in recent years are equipped with concentrators. The concentrates are shipped for treatment.

[1] Brown, E. Percy, Can. Min. Jour., Aug. 15, 1908.
[2] Report of the Department of Mines, 1906, p. 52.

The following figures of costs and wages at the Richardson mine may also be of interest:—

"Coal, average cost, $4 per ton.

Dynamite, average cost, $0.20 per pound.

Wages—Drillmen, $1.75 per day.
Helpers, $1.50 per day.
Trammers and muckers, $1.50 and $1.35 per day.
Millmen, $40 to $65 per month.
Cyanide men, $2 per day.
Hoistmen, $2 per day.
Engineers, firemen, and machinists, $1.65 per day.
Blacksmiths, $1.75 to $2.50 per day.
Carpenters, $1.60 to $1.75 per day.
Labourers, $1.35 per day."

Companies have been formed at different times to treat old tailing beds, but the only place where it was carried on extensively was at the Micmac, Leipsigate. Some attempts have also been made to recover the arsenic from the mispickel, but without success.

[1] Can. Min. Jour., June 15, 1907.

DESCRIPTION OF THE GOLD DISTRICTS.

INTRODUCTORY REMARKS.

The following sketches of the districts are at best exceedingly fragmentary. With regard to the geology, the character of the deposits, and the general development the available information is in many cases very incomplete. Much information that might prove of great value has been lost through the general neglect, especially in the earlier days, to keep plans of the workings, showing the extent of development and the character and value of the ore extracted.

With regard to the history it was seldom that sufficient data were available to make a connected and readable account of the events taking place in any particular district; in fact, so meagre were the data in some cases that little else could be given than a list of the companies operating during different years and of the properties on which operations were conducted. Considerable difficulty arises in tracing the development of any particular deposit on account of different names being applied to the same vein in successive years or even in the same year, also on account of the names of companies being frequently given without any information as to what particular deposit was being worked. Properties have changed hands, mines have been closed and reopened, and companies have been formed and passed out of existence of which little or no record has been kept. The history must, therefore, often be lacking in balance and due proportion, and can be little more than the joining together of a few facts making a much broken and disconnected chain.

Suggestions are sometimes given as to the course it might be advisable to pursue in further explorations. It must, however, be remembered that some of these are based on the pay-zone theory, which has been advanced not without strong evidence by Faribault, but which, while of general application, it is admitted by himself may fail in certain particular cases where conditions change with depth.

Incomplete and distorted as these sketches must be, they are given to the public in the hope that some of the contained information will be of value, especially to those interested in any particular district.

As has been explained already, the veins occur usually in groups, and to a locality in which one or more veins of a group have been worked the term district has been applied. The districts were surveyed into small rectangular divisions known as areas, which were usually laid out according to the general strike of the veins. The size of the areas is 150 feet by 250 feet, although some were at first only 20 feet by 50 feet, and the shorter dimension is in the direction of the strike of the vein. In a few districts, however, they were surveyed with their longer dimensions running magnetic north. The larger subdivisions of the districts are called blocks, each of which comprises 1,000 areas. Plans of twenty-six of the most important districts have been published by the Geological Survey.

ARDOISE.

The Ardoise gold district is situated in Hants county, 5½ miles east of Ellerhouse station on the Dominion Atlantic railway.

[1] The veins lie in the pyritous slates of the Halifax formation a short distance south of the synclinal axis, and about 2 miles north of the Rawdon Mines anticline. The strata here are overturned; they strike about N. 65° E. (magnetic) and dip south 80°, forming a broad curve with its convexity facing south similar to that on the south limb of the dome at Mount Uniacke.

[1] Ann. Rep. Geol. Sur., Can., Vol. XII, 182 A.

The most of the veins are of the interbedded type and show rolls dipping at high angles. A 14-inch belt carrying five veins has received some attention. One vein, known as the Big lead, is composed of rolls 6 inches to 36 inches thick, dipping east 72°; angulars enter this from various directions. The main lead has rolls 1 inch to 10 inches thick and the Little Rich lead is 3 inches wide. A cross vein, known as the Mason vein, is 4 inches wide and carries a large proportion of sulphides.

[1] A discovery was reported from this district in 1868 and considerable prospecting has been carried on at various times, but it has not led to any extensive mining. A 10-stamp mill was erected, and a few shafts were sunk, but to no great depth. Some of the veins were tested by open-cuts a few feet deep. Some assays made by Mason, of Halifax, of an auriferous slate belt holding quartz veinlets, would seem to warrant development work.

BEAVER DAM.

Beaver Dam gold district is situated in Halifax county on the Killag branch of the West river, Sheet harbour, 7 miles east of the Musquodoboit coach road.

The Goldenville formation, here much metamorphosed, is folded in an overturned anticline running northwest and southeast. The strata on the south limb dip north at angles varying from 75° to 85°, while those of the north limb dip north at lower angles. The country is low and drift-covered and hence difficult to prospect. The veins are of the interbedded type and those that have received the greatest attention lie on the south limb. Much rich drift was found in the northwestern part of the district on the Van Buskirk areas, and the veins exposed here in trenches cut by Dimock and Zwicker lie on the north limb of the fold.

A discovery was reported from this district in 1868, and in 1871 a 15-stamp mill was erected and two belts of promising veins were opened. Later on, D. J. Thomas worked here a few months for an English company, but the district received scant attention until William Yeadon became interested in 1886. During this year there was considerable prospecting, Yeadon erected a 4-stamp mill, run by water power, and carried on development work. He also carried on steady work during the following year. In 1891 Mr. Yeadon sold out to the Beaver Dam Mining Company and the tests made by this Company were so promising that a 10-stamp mill was erected. In 1891 work was managed for this Company by D. S. Turnbull. Little seems to have been done, however. In 1895 the property was leased by G. M Christie and Wm. Tupper, who had 15 men employed but apparently did not carry on very extensive operations. In 1896 the mine passed into the hands of J. H. Austin, who erected a 10-stamp mill.

A few years later considerable prospecting was done by Messrs. Levi Dimock and Gordon Zwicker on the Van Buskirk areas about one mile west of the other workings of the district, and several corrugated auriferous leads were cut dipping north.

In 1904 a 5-stamp mill was erected in this district by W. H. Redding and a new mill license taken out. No record is found of the results.

Developments are limited, but sufficient to show that auriferous veins are distributed along the anticline for a distance of at least a mile, in some cases forming large deposits of low grade ore. In 1902 a 98 foot shaft had been sunk on a belt 15 feet wide, and cross-cutting 62 feet north and 39 feet south revealed an auriferous belt 74 feet wide, half of which was quartz and slate giving an average value by sampling of $3.50 per ton. The same belt was uncovered 400 feet farther west. The surface trenches cut by Dimock and Zwicker across 785 feet of strata also exposed a great number of leads, some of which were found to be auriferous.

BLOCKHOUSE.

Blockhouse is situated in Lunenburg county a short distance west of Mahone Bay, and 1 mile west of Blockhouse station on the Halifax and Southwestern railway. The chief workings in this locality are on a cross vein about 1 foot wide, running N. 13° W. and dipping 70°, with a pay-streak

[1] Rep. Chief Commissioner of Mines, Nova Scotia, 1868, p. 8.

No returns were made in 1893, but it seems that in the latter part of the year John McGuire returned to the district and made some tests preparatory to reopening his old mine and treating the tailings dump by some chemical process. The property apparently soon passed into the hands of the Brookfield Mining Associates, W. L. Libbey, manager, for this Company made returns in 1894, and in 1895 an incline had been sunk on the vein from the engine house through the old workings to the bottom of the main shaft and a large quantity of ore stoped out and milled. During this year the old Philadelphia mine in the eastern part of the district was bonded by M. T. Foster and Herbert Dixon, pumped out, and repaired, and a small amount of ore crushed; while Peter Dunbrack obtained by mortar a small amount of gold from a vein he had recently discovered in the northwestern part of the district.

In 1896 a large amount of ore from the Brookfield Mining Associates property was crushed and important additions were made to the plant to secure a better extraction of the gold and increased economy in the management of the business. A 20 stamp mill was erected and work was started on a chlorination plant for treating the concentrates. Three men were employed on the Dunbrack lead in the northwestern part of the district and fourteen men were at work for a time at the Foster and Dixon mine. This last mine was closed, but in 1897 it was again unwatered, this time by the Philadelphia Mining Company, and a small amount of ore was crushed.

The chlorination plant of the Brookfield Mining Company, Ltd., was completed early in 1897 and was at once put into operation. Operations were vigorously carried on at this mine and over 4,000 ounces of gold was reported. This mine, commonly known as the Libbey mine, continued a steady producer until 1906, and a study of the returns for the district will show on what an extensive scale operations were carried on. The yearly returns form a record of the history of the mine. It is a story of continual development and production. In 1898 and 1899 about seventy men were employed, a 20 stamp mill and concentrators were kept running, and the concentrates were treated by the Thies process of barrel chlorination. In 1899 the seventh level was driven at a vertical depth of 582 feet. In 1901 the tenth level was driven at a vertical depth of 762 feet, and eighty men were employed. In 1902 the eleventh level was started, and besides stoping the cross vein a small amount of work was done on the Mill lead. During the next year all the work was confined to the area below No. 9 level, and 300 feet were driven on the twelfth level and 80 feet on the thirteenth. Some experiments were made by C. D. Maze with the bromo-cyanide process of treating the tailings, and the question of putting in a cyanide plant to replace the chlorination plant was under consideration at the time of the inspector's visit and before the end of the year a bromo-cyanide plant was erected.

In 1904 the work was confined to levels 11, 12, 13, and 14, and a vertical depth of over 1,000 feet was reached. The cyanide plant started operation and treated some old tailings beds, and stock from the mill. This plant was kept at work during 1905 and the fourteenth level was extended. In 1906 no returns were made, and early in the year this mine, which had been so successfully operated for 12 years under the able management of W. L. Libbey, was closed.

Work in other parts of the district has been of a very desultory nature. We saw that in 1897 the old Philadelphia Company's mine was reopened, and that year a small production was reported by J. B. Neilly. In 1898, 1899, and 1900, the same person is credited with a small yield. In 1899 R. L. Sherman had twenty-seven men employed on the Philadelphia Company's property for J. B. Neilly; some work was done on both the Nelson and East Mine veins; nearly 700 tons of ore was milled and the tailings concentrated by means of a Wilfley table. The mine was closed in 1900 but was secured by the North Brookfield Mining Company, Noble Crowe, manager, and in June, 1901, the East mine was unwatered. Early in 1905 a cyanide plant designed by H. S. Badger was erected and put in operation, and from 1,890 tons of ore crushed a yield of 888 ounces of gold was reported. Work was continued here during a part of the following year and the Company returned 218 ounces of gold from 512 tons of ore.

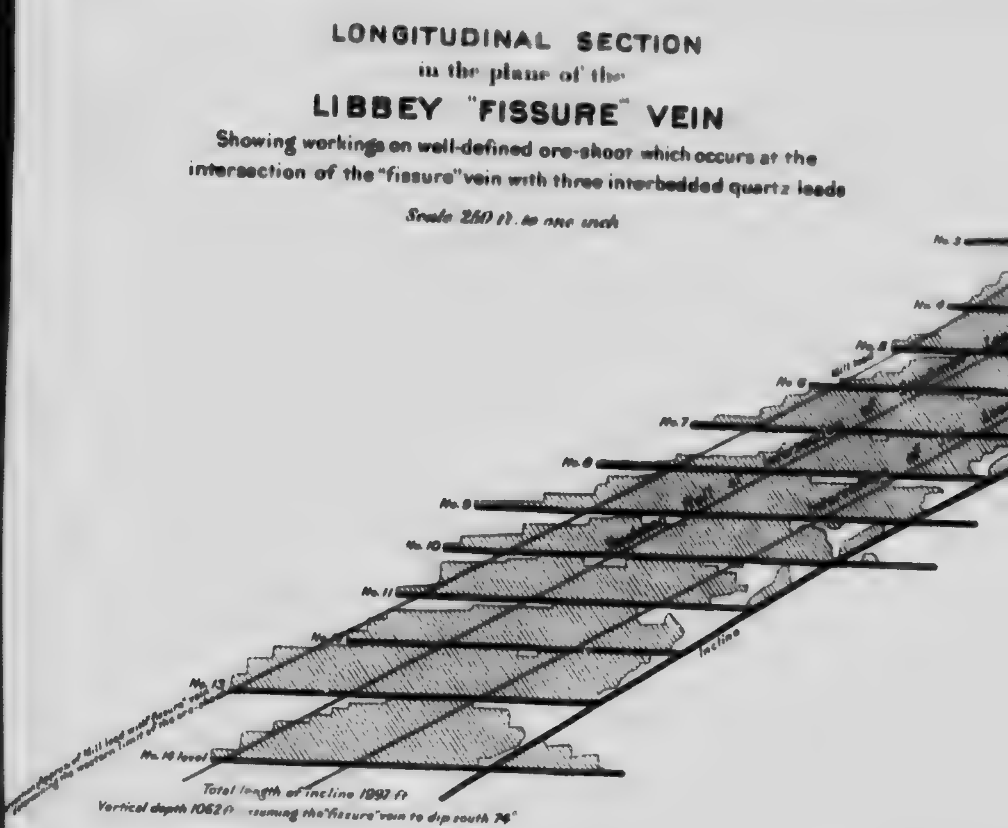
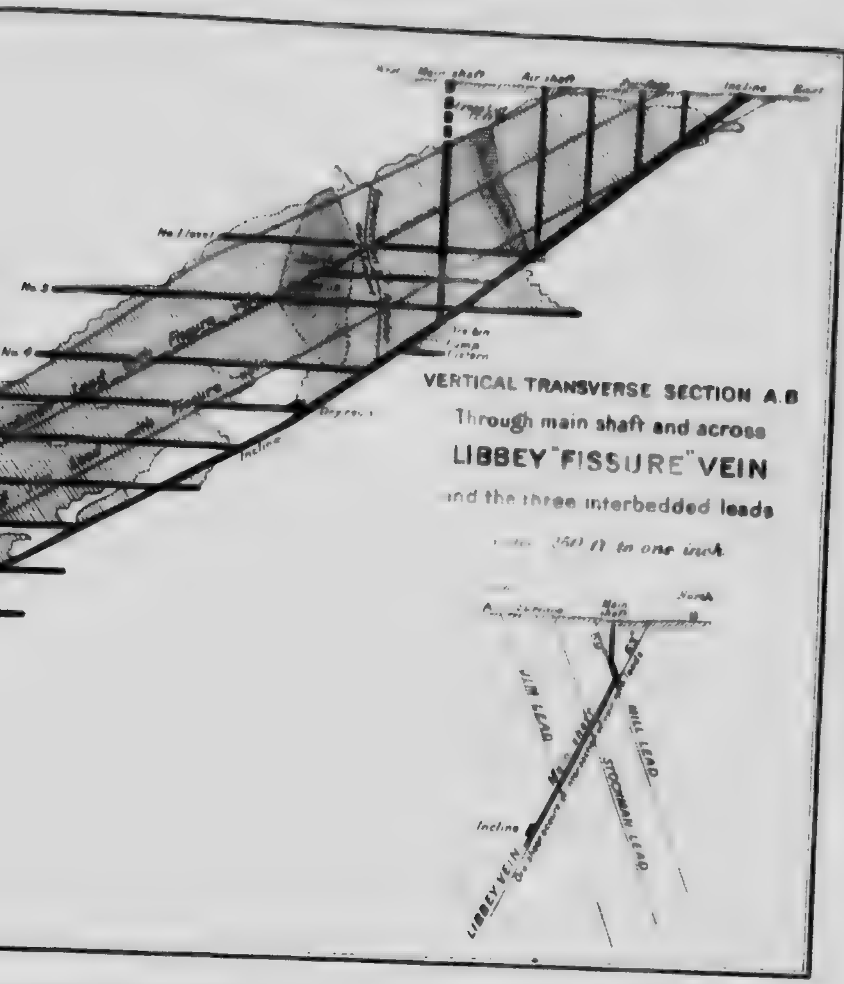


Fig. 1. Sections of the Libbey Fissure Vein—Brookfield



Brookfield Gold District, N. S.

To accompany Memoir No. 20

In 1905 some rich ore was mined by A. M. King in the southern part of the district on a small body of ore known as the King streak. In 1908, a small return was made by A. M. King. During a portion of this year the Ophir Gold Mining Company had eleven men employed under the management of G. G. King on a 3 foot cross vein in the southern part of the district. A shaft was sunk 125 feet, a 5 stamp mill was erected, and a Wilfley table put in. In 1909, a little work was done and the 100 foot level was extended 175 feet.

General Development.

The section accompanying the published plan of this district shows the extent to which the Libbey vein has been worked. An incline shaft follows the lower edge of the pay-shoot and reaches a total length of 1,997 feet. This would mean a vertical depth of 1,062 feet, assuming that the vein dips at an angle of 74° to the south. In addition to the inclined shaft there are several shafts on the dip of the vein by which the ore near the surface was removed. Later a vertical shaft was sunk to the west to a depth of 350 feet to meet the inclined shaft. The inclined shaft was then continued along the pay-shoot. Ore was hoisted along the incline to the main vertical shaft through which it was then raised to the surface.

From the incline, levels were driven west, fourteen in number, and extending in length from 400 to 500 feet, and nearly all the quartz between these levels was stoped out. The fourteenth level was also extended east 178 feet to test the ground in that direction.

Some tests were made of the interbedded leads intersecting the Libbey mine. The Mill lead at a depth of 100 feet was followed for 30 or 40 feet and measured 8 feet 6 inches in thickness; in No. 8 level it was followed 40 feet west of the intersection and showed 18 inches of quartz in two veins lying close together. Another interbedded lead was driven on from levels Nos. 8, 9, 10, and 11 and showed 7 inches of quartz.

At the East mine three shafts have been sunk: the west shaft 235 feet, the middle or main shaft 300 feet, and the east shaft 205 feet.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1887	1,418	1	15	1,691	0	16	18
1888	...	...	...	...	...	...	...
1889	1,796	17	18	1,472	1	4	9
1890	1,643	5	0	2,500	0	13	0
1891	...	...	...	...			
Year end. Sept. 30.							
1895							
1896	1,992	3	4	3,344	0	11	21
1897	4.683	17	15	5,353	0	17	15
1898	3,366	10	0	8,076	0	5	7
1899	3,874	18	0	1,112(?)	0	6	22
1900	2,982	18	5	9,212	0	6	11
1901	2,726	16	13	9,291	0	5	20
1902	3,253	10	0	7,709	0	8	11
1903	3,051	5	1	7,736	0	7	21
1904	2,872	11	0	10,143	0	5	16
1905	3,297	0	19	10,534	0	6	6
1906	4.866	19	4	12.657	0	7	16
1907	218	10	0	513	0	8	12
1908	2	5	0	15	0	3	0
1909	21	0	16	155	0	3	2

CARIBOU.

Location.

Caribou gold district is situated in the northeastern part of Halifa county, 6 miles south of Musquodoboit valley and 35 miles east of Shub acadie station on the Intercolonial railway, from which it is accessib by a good wagon road.

Geology.

The district lies on a dome formed by the plunging of an anticli to the east and west, the anticline being the same as that which pas through Cochrane Hill and Cameron Dam. Folding and subsequent erosi have been sufficient to expose the upper beds of the Goldenville format in the form of an elongated ellipse, 2,900 feet broad and 4 miles long, wh more remote from the centre of the dome and overlying the quartzites the slates of the Halifax formation. The dome has its centre on areas and 329, block 2, and from this centre the axis runs N. 79° E. (magnet plunging to the east at a higher angle than to the west, while the dip of t strata to the north and south increases gradually from a very low ang near the centre to 65° on the north limb and 70° on the south. There has b a certain amount of faulting, but nearly all the breaks are of a pur local nature with only slight horizontal displacement; one of these ru from the centre of the dome in a southeast direction, halfway betwe Burkner and Middle lakes, while another runs a little south of t anticlinal axis and nearly parallel with it.

Character of the Deposits.

These two types of auriferous quartz veins are represented in this d trict, the interbedded and the cross vein, the former being found in t Goldenville formation chiefly in the slate beds interstratified with t quartzites, the latter chiefly in the lower beds of the Halifax formati near its contact with the Goldenville formation. Among the veins th have been most extensively worked are the Caffrey, Lake, Dixon, Burkne and the McDonald. The first of these is an interbedded vein; the othe are all cross veins found near the base of the Halifax formation, wi the exception of the Dixon vein, which crosses the Goldenville formati at the western end of the dome. The cross veins usually cut the strata at small angle. The outcroppings of the interbedded veins, as might be pected, form portions of ellipses, while those of cross veins lie in mo less straight lines of no great length, the vein extending in length little beyond the pay-shoot. Many unexposed interbedded veins unde those that come to the surface, and a vertical shaft sunk 70 feet in on the west plunge of the anticline just north of the old workings on Flat leads (so-called) cut nine leads ranging from 2 inches to 10 inche thickness; all containing arsenopyrite and seven containing free gol

Some of the interbedded veins worked on the western end of the d are very flat, that is they dip at a very low angle, and thus render mi very expensive on account of the great amount of barren rock that mus removed to make room for the miners. In some cases they are w by open-cut

The ore occurs, in many veins at least, in rich shoots. In the M Donald vein, a vertical vein 1 foot thick, the ore occurred in rolls 5 f thick dipping west 52° and following the intersection of the vein with t strata. From a stope of 40 feet carried to a depth of 120 feet 1,170 ounce of gold was taken. The rich shoot on the Burkner was found to dip wes 45°, with its bottom following the intersection of the vein with the to the Goldenville formation. One of the most striking examples of a pa shoot in the gold-fields of Nova Scotia is that of the Lake lode, in wh an auriferous body of quartz, in some places at least 20 feet thick, a dipping to the west at an angle of about 45°, has been followed to a vert depth of 1,000 feet, and it is claimed by those who have worked in the m and are well acquainted with the conditions that this shoot extends to st greater depths, but that the cost of removing the ore is excessive ow to the necessity of hoisting it 300 feet through the auxiliary winze, tramming it to the main shaft for hoisting to the deck.

PLATE XVIII.

Ore shoot on the Lake lode, Cariboo, at a depth of 1000 feet.

[illegible] 124

Attention might here be called to the occurrence about a mile north-east of Caribou district at the north of Sherlock lake, of numerous mineralized quartz veins on the apex of the anticline near the contact of the Goldenville and Halifax formations. It seems that these have as yet received little examination.

History.

It is not known who was the discoverer of gold in this district, but among those who engaged in work here during the early days may be mentioned Messrs. Hyde, Bushing, Touquoy, Burkner, and Jennings. Some of the operations carried on in the early days at Moose River were described in the Reports of the Department of Mines under the heading 'Caribou.' This causes some confusion and it may be that some of the work noted in the following paragraphs was carried on in Moose River instead of Caribou.

Operations began in this district in 1867 and prospecting was prosecuted during the following year with such success that two crushers were built and put in operation in April, 1869, one of 10-stamps by Mr. Hyde and one of 8-stamps by Mr. Bushing. A tramway 3½ miles long was constructed to connect Mr. Hyde's mine with his mill on the south branch of Fraser brook. His operations were limited to what was later known as the Hyde lead and is indicated on the plan as the Caffrey lead. The lead was opened by seven shafts averaging about 50 feet in depth, and it was stoped from this depth to within 6 feet of the surface throughout a length of 600 feet. A lode was opened by Mr. Burkner 1,000 feet south of the Hyde lode. The Bushing belt, consisting of alternations of quartz and slate making a thickness of 20 feet, was found to branch at the east and one part turned northward. At the west end four shafts were sunk and four shafts also on the north branch and a considerable amount of stoping was done. Some work done during this year on a nearly horizontal lead known as the Dunbrack resulted in a yield of 71 ounces from 22 tons, and a little work done at the Touquoy mine on a small cross vein produced a ton of quartz that yielded 23 ounces. The returns from the district for this year show a yield of 1,001 ounces from 1,583 tons.

The Bushing and Hyde mines stopped work early the next year, probably from want of proper machinery. Late in 1871, however, the discovery of rich boulders on the Bushing areas led to prospecting which resulted in the discovery of a nearly horizontal lead, 5 to 10 inches thick, on the crown of an anticline. Three small shafts were sunk and a portion of the vein removed.

Mr. Touquoy worked continuously during 1870 and 1871, in the former year extracting 327 ounces from 338 tons and in the latter year 405 ounces from 380 tons of quartz. His work consisted of sinking, stoping, and open-cutting on the North, and the South or Flat leads, and on a cross vein.

In 1870, Messrs. Jennings and Wilson began operations on the Free Claim lode and continued work during the following year in the way of sinking, stoping, and open-cutting.

In 1872 work continued at the Pioneer mine on the Ritchie lode until April. This horizontal, corrugated lode was 3 to 14 inches thick and lay within a few feet of the surface. Mr. Touquoy's work was limited to the North and South leads, on the former of which sinking, drifting, and stoping were prosecuted and on the latter open-cutting. On the Free Claim lead Messrs. Jennings and Wilson continued sinking.

Very little was done in this district in 1873, but in the following year a little more interest was shown. Mr. Touquoy, who had been working the Ritchie lode on tribute, returned to his own areas and resumed sinking and stoping. Work on the Hyde lead was resumed and Mr. Caffrey sunk the shaft deeper and stoped a part of the vein. Some trenching was done on the Pioneer property and Messrs. Touquoy and Caffrey did some trenching on the so-called Reid block, and sank three small shafts.

About the only work done in 1875 was that by Mr. Caffrey on the Hyde lead, areas 227 and 228. In the following year work was continued on this lead by Messrs. Caffrey and Lawson, and an 8 stamp mill was erected. Mr. Touquoy returned to the district, prospected his areas, and discovered a 3 inch lode, which, although yielding one ounce per ton, could not be worked profitably as the dip was so low as to necessitate the removal of

much barren rock to make head room. In this year the McDonald vein was discovered which yielded 2 ounces per ton. This rich pay-shoot held out until July, 1877, and 1,170 ounces were taken out from a stope of 40 feet within a depth of 120 feet.

In 1877, a shaft was sunk 115 feet deep on the McDonald vein on area 630 without finding paying quartz, and much prospecting was done in the vicinity, 1,500 feet of trenches being cut. Work on the Hyde lead on area 227 was carried to a depth of 250 feet, when the destruction of the mill and hoisting gear by fire brought operations to a close. However, Mr. Caffrey rebuilt his mill and engine-house and work was carried the next year to a depth of 270 feet. Some distance west of the Hyde lead, Mr. Touquoy opened in 1877 a cross lead 6 inches thick, which, yielding at first from 2 to 3 ounces, promised well, but in the end proved unprofitable. He also cut 4,000 feet of trenches on the anticline over a mile farther west, at the south end of McLeod lake, but found nothing of value. On the Jennings lead, area 474, and next the Free Claim, some stoping was done.

In 1878, much prospecting was carried on at the east end of Burkner lake, but although the boulders were numerous and rich enough to pay the expense of prospecting, the lead from which they came was not found. 40 tons of these boulders was collected and crushed, of which 7 tons yielded 15 ounces. On the Pioneer property a shaft was sunk 100 feet on two angling veins. On area 424 some stoping was done.

Several years succeeded in which work in this district was nearly at a standstill. In 1879, a little work was done by tributers, and in 1880 some work was done on the Free Claim lead, area 474, and Mr. Touquoy mined the flat lead west of the road. In the following year little was done except on the Lowell property, areas 373 and 374, and by R. G. McDonald & Co. In 1882, the old Jennings property received a little attention, and in 1883 the same property was worked by Mr. Caffrey for a short time. In this year, Mr. Touquoy worked a cross lead.

In 1884, Mr. McDonald was working near the Free Claim, the Caffrey mine was unwatered, and Messrs. Stuart, Gladwin, and others opened a lead near the lake and sank about 35 feet on it. The Lake lead, opened the preceding season, was worked successfully in 1885, during which year Mr. Touquoy continued operations and Mr. Wright worked on the Heatherington property.

In 1886, Mr. Bruce worked on the North lead, and Mr. Wadworth carried on operations at the Lake lode for some Americans by whom it had been purchased. A 5-stamp mill was in operation here.

In 1887, Robt. Wright raised good ore from some of the flat lodes in the vicinity of the old Heatherington property. The Lake Lode Company pushed operations on their property, opened a new shaft, and put in new machinery. This mine continued a steady production for several years. During the following year this Company opened the Caffrey property.

In 1889, the Lake lode furnished plenty of ore, but the work at the Caffrey mine was chiefly of an exploratory character. On the Heatherington property a lode was opened by several pits and the construction of a crusher was commenced. In 1888, Messrs. Henry Archibald, Herbert Dixon, and Gordon Zwicker purchased seventeen areas west of the Touquoy and Caffrey properties, and during the next year underground work was pushed vigorously, a very promising lode was developed, and a 5-stamp mill erected. The returns from this, the Dixon property, for 1890 showed an average yield of over 1 ounce per ton. In 1890, returns were also made from the Lake lode and the Caffrey properties.

In 1891, the Dixon mine was being worked and operations continued here for several years, but the Lake lode and the Caffrey mines were idle although the former was kept pumped out.

In 1892, R. Wright and others did considerable prospecting, twenty men were employed at the Dixon mine, and George Stuart began to develop the Burkner lode. Stuart took charge of this mine in October for the Truro Gold Mines Company and, after testing it and finding good ore, put in new machinery.[2] He reported to his Company a clean up of 750 ounces from 30 tons of quartz mined during November 1 to 17, and December 14 to 30. Work continued at this mine during a part of 18[illegible]

[1] Can. Min. Review, Jan. and Aug., 1891.
[2] Canadian Mining Manual, 1893, p. 484.

PLATE XIX.

Surface plant of the Guffey Jennings Gold Mining Co., Cariboo.

but ceased late in the year. Then it was sold to Mr. Stuart, and in 1896 was taken over by the Cariboo Gold Mining Company, and work started again under the management of Stuart. This year the Cariboo Gold Mining Company secured the Caffrey, Huntington, Dixon, Tonquoy, Amherst, and Bruce properties, but according to the 'Critic' of June 4, 1895, the property was said to be for sale again.

In 1893, the old Lake lode was unwatered and retimbered by W. H. Saunders; work continued at the Dixon mine; R. Wright employed four men on the old Caffrey property and E. C. McDonald and H. H. Anderson started a vertical shaft on the anticline. The next year the main shaft at the Dixon mine was continued to a depth of 230 feet and twenty-five men were employed, while W. H. Saunders had fourteen men at work on the Lake lode mine.

At the latter mine thirty-six men were employed in 1895, the shaft was down 160 feet vertically and 510 feet on an incline of 36°, and all the machinery had been remodelled and a new 10-stamp mill erected. Eight men were employed on the Caffrey property, and R. McLeod had forty men at work at the Dixon mine, where the shaft had reached a depth of 300 feet. The Bell mine on the McDonald lead was unwatered and retimbered under the management of W. J. McIntosh, and a new 15-stamp mill was erected. Work continued the next year on the Lake lode, the Dixon, and the McDonald mines, W. A. Saunders being manager at the first, A. McLeod at the second, and Patrick Carr at the third.

In 1897, the Lake lode mine was purchased by the Guffey Jennings Gold Mining Co., Ltd., and under the management of L. W. Getchell a new vertical shaft was started. Work was continued on this shaft the next year under the management of H. Guffey and a depth of 400 feet was reached. In 1897, the Elk Gold Mining Company had eighteen men employed in the northern part of the district under the management of F. Prince, but during the following year little was done. Under the management of Fred. Darragh, a little work was done about the mill and the pumps were kept going. A little work was being done at the Dixon mine in 1897 by W. J. Davison, manager, but the water had been permitted to rise within 90 feet of the surface.

The Truro mine was reopened in 1899 by W. J. Davison and a test lot of 100 tons taken out, and in 1900, Messrs. Sinclair and Logan unwatered the mine and took out a test lot of 30 tons. In 1899, Otto Collins had five men at work at the Elk mine and a little work was done here also during the following year.

Work was continued in 1899 at the Guffey Jennings mine under the management of H. A. Guffey, the vertical shaft was sunk to a depth of 500 feet, levels were driven, a cross-cut run to the north, and some new machinery put in. During the following year driving levels, cross cutting, and stoping were conducted under the management of W. J. Prisk.

This property passed into the hands of the Baltimore and Nova Scotia Mining Company and active operations were carried on here for several years. In 1901, L. W. Getchell was manager, and W. J. Prisk superintendent, fifty men were employed, and sinking, driving levels, and cross-cutting and stoping were continued. A new 40-stamp mill, with 20 stamps on each side, back to back, was erected. During this year a cyanide plant with a capacity of 100 tons was erected on the Elk property to treat the old tailings, but in the autumn of the same year it was removed to Isaac Harbour.

The Baltimore and Nova Scotia Mining Co. continued sinking, driving levels, and stoping in 1902 under the management of L. W. Getchell. The vertical shaft was sunk to a depth of 700 feet; details are given in the Report of the Department of Mines for Nova Scotia as to the extent of the work done. Sixty-two men were employed in 1903, and the ore-shoot pitching to the west was followed by means of levels and a winze sunk from the 700 foot level. During the next year about the same number of men were employed, a vertical depth of 1,000 feet was attained in the mine, stoping was active, and the cross-cut at the 700 foot level was extended nearly 900 feet south. In January, 1905, work at the mine temporarily ceased while the government drill was employed in prospecting but was resumed later. During 1906 and 1907, no work was done at the mine, but the water was kept down to the 700 foot level.

On June 10, 1906, work was commenced in what is known as the north shaft at the Dixon mine under the management of G. H. Lawlor, and 150 tons of quartz was taken out. During the next year 119 ounces of gold was extracted from 174 tons of quartz, but mining ceased at the end of March.

In 1908, a large portion of the Caribou district was purchased by M M. R. Holman and consolidated under the name The Caribou Gold Min[illegible] Under the management of L. W. Getchell, extensive prospecting and development work was commenced at the Dixon, Truro, Lake, and Flat lode and a new vertical shaft called the Holman shaft was started on the centre of the dome. At the Dixon mine some cross-cutting was done; the Truro mine was unwatered, some retimbering done, the 130 foot level continued west 270 feet, and a small amount of ore stoped out; repairs were also made on the equipment. The 40 foot shaft, sunk a number of years previously on some flat leads, was unwatered, and retimbering was started. The shaft at the Lake lode was kept unwatered, the intention being [illegible] sink an incline shaft from the station at the 700 foot level, to follow along the lower limits of the pay-shoot. This incline had reached a depth of 90 feet by the end of September, 1909. In July, 1909, the surface equipment at this shaft was destroyed by fire, but rebuilding was at once commenced. Mining was carried on continuously this year on the flat lodes, and after the destruction of the mill at the Lake lode the ore was crushed by the Dixon 10-stamp mill, which was taken down and re-erected just north [illegible] the Holman shaft. Little was done during the year at the Holman shaft or on the Truro lode.

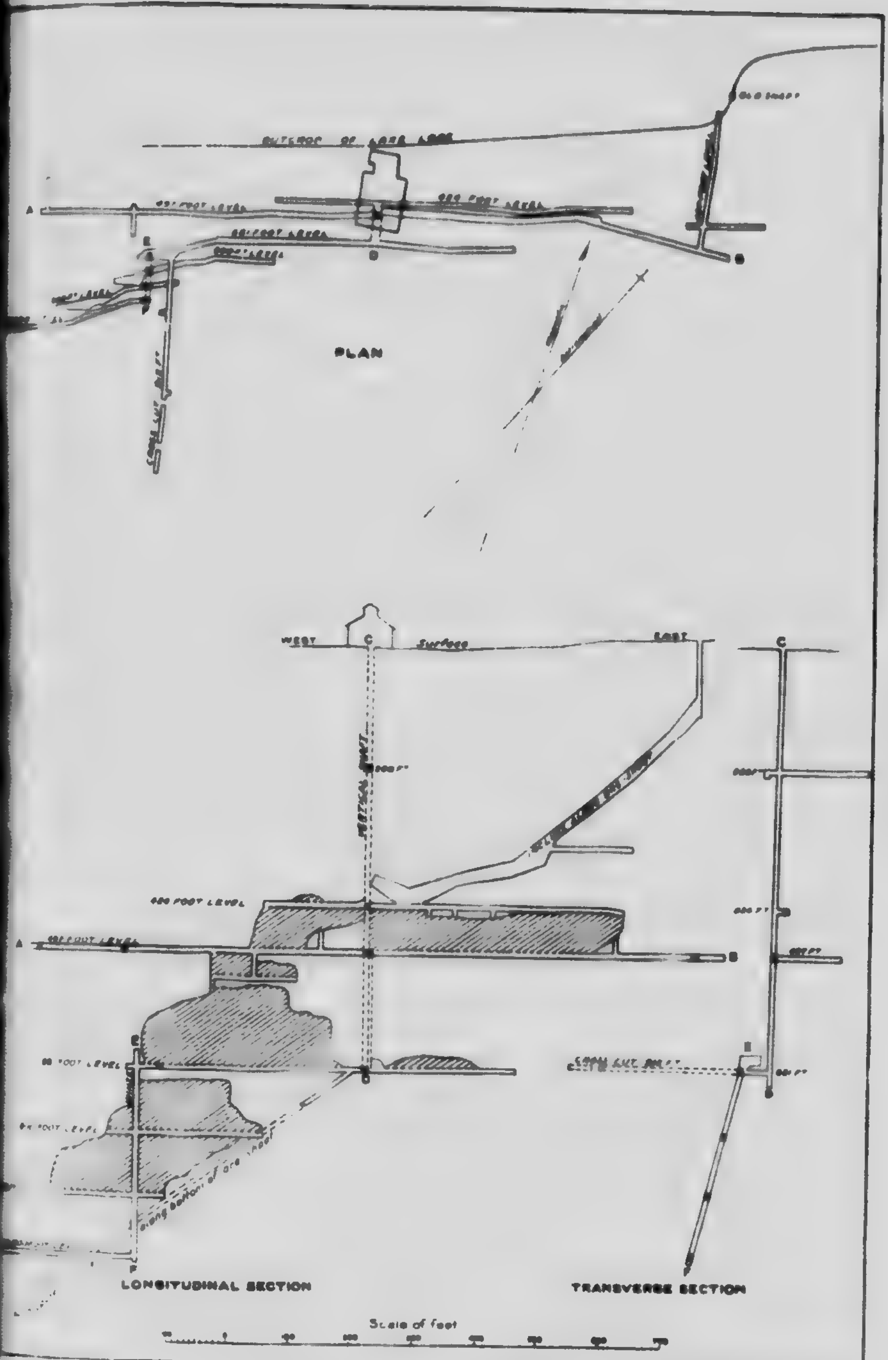
General Development.

Regarding the general development, very little definite information [illegible] available, aside from that contained on the published plan, where [illegible] location and depth of the shafts are indicated. The work has consisted chiefly in sinking shafts, driving levels, and stoping, and only a very subordinate amount of cross-cutting has been done for the purpose of prospecting new ground or developing veins already discovered.

The accompanying plans and sections of the workings on the Lake lode show the extent to which operations have been carried on in the development of that ore body. The ore was approached at first by a vertical shaft, which was carried to a depth of 160 feet, and from the bottom of this an incline was run to the west several hundred feet to keep in touch with the pay-shoot. Later the old vertical shaft and the incline were abandoned and a new 700 foot vertical shaft was sunk some distance to the west, and by means of short cross-cuts the ore-body was tapped. As the pay-shoot continued dipping to the west it was considered advisable to approach it by a winze sunk from the 700 foot level. The ore has been practically all removed from the surface to the 900 foot level and a level had been driven at a depth of 1,000 feet, and it is expected that the thickest part of the shoot lies at this level a little farther to the west. Work ceased [illegible] 1905, but the owners still had confidence enough in the mine to keep it pumped out to the 700 foot level, and an incline shaft from the bottom of the 700 foot vertical shaft to follow the lower limits of the pay-shoot was started in 1909 and run 90 feet. Considerable cross-cutting and boring has been done here to explore new ground. Some short cross-cuts were driven in addition to one driven 912 feet to the south from the 700 foot level, which is reported to have cut a few belts. In 1905, exploratory work was carried on by means of the government drills and a horizontal hole driven south from the face of the 912 foot cross-cut intersected the following strata:—

	Feet.	Inches.
Black slate..	30	0
Black and grey slates..	47	5
Grey slates..	232	7
Black and grey slates mixed..	92	0
Total..	402	0

Another hole was drilled south from the 500 foot level at a point [illegible] feet west of the shaft and opposite the north cross-cut, but it seems that no ore body was struck.



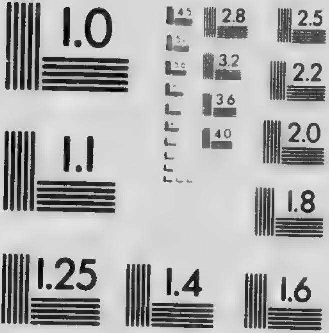
To accompany Memoir No. 20

Fig. 2 — THE LAKE LODE MINE

CARIBOU — SEPT. 1909

MICROCOPY RESOLUTION TEST CHART

ANSI and ISO TEST CHART No 2



APPLIED IMAGE Inc

Production of Caribou and Moose River.

Year.	Gold extracted.			Ore crushed.	Yield per ton 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1869	1,001	0	23	1,583		12	17
1870	613	[illegible]	2	755		16	6
1871	504	15	23	479	1	1	1
1872	209	[illegible]		368		11	9
1873	17	16	12	21		16	23
1874	338	10	23	333	1	2	3
1875	446	12	19	368	1	4	6
1876	727	4	10	542	1	6	[illegible]
1877	2,596	13	23	1,735	1	9	21
1878	1,026	12	16	928	1	2	2
1879	676	1	21	781		17	7
1880	823	5	19	824	1	0	0
1881	1,129	18	13	1,661		13	14
1882	588	6	11	1,601		7	8
1883	477	11	6	2,094		4	14
1884	966	19	22	1,559		12	9
1885	1,335	14	11	2,239		11	9
1886	2,233	17	16	3,087		14	10
1887	1,861	9	22	2,689		13	20
1888	2,729	10	15	6,313		8	16
1889	1,906	1	10	7,338		5	4
1890	1,576	19	8	6,661		4	17
1891	1,486	14	21	5,489		5	1
1892	2,335	16	10	7,189		6	11
1893 (9 mos. ended Sept. 30)	1,549	15	5	4,701		7	14
1894	2,779	16	17	9,727		5	17
1895	3,189	11	1	11,565		5	12
1896	2,864	13	1	13,918		4	2
1897	2,781	13	19	9,324		5	23
1898	1,201	7	19	6,188		3	21
1899	954	13	4	13,116		1	16
1900	1,633	6	23	8,348		3	21
1901	2,341	5	6	6,893		6	19
1902	2,162	0	21	9,890		4	9
1903	3,653	3	8	11,961		6	3
1904	1,856	19	12	10,592		3	12
1905	1,319	1	10	13,998		1	21
1906	831	1	16	9,268		1	19
1907	638	8	3	4,458		2	21
1908	132	0	0	1,240		2	3
1908 (Moose River)	890	10	0	8,952		2	0
1909	284	6	0	1,055		5	9
1909 (Moose River)	1,079	6	0	9,479		2	7

CARLETON.

The Carleton district is situated near the village of Carleton in Yarmouth county, 16 miles northeast of Yarmouth and 5 miles from Brazil Lake station on the Dominion Atlantic railway. The Tusket river, which furnishes large water-power, is in the immediate vicinity.

[1] The vein that has received the most development crosses the strata, running almost due east and west. Several other veins have been prospected.

[1] The Critic, Oct. 29, 1886.

[1] Gold was discovered in this district early in the spring of 1886; in the summer a good vein was exposed and before the close of the year a small crusher was erected, to be run by water-power; shafts were sunk about 100 feet; 300 feet of levels was driven and about 50 tons of rich ore taken out. It is reported that several tests showed a yield of 2½ ounces per ton. [2] On this property, which was sold by Messrs. Gale and Ross to Messrs. Hatfield and Uhlman, the shaft was sunk 100 feet deeper in 1887 and good ore was followed to the eastward. Some veins were prospected on the adjoining property by Messrs. Turner & Co., and about 700 feet north Messrs. Miller, Crosby, & Co. opened a belt.

CENTRAL RAWDON.

Location.

Central Rawdon district is situated in the central part of Hants county, 5 or 6 miles east of Mosherville, a station on the Midland branch of the Dominion Atlantic railway, from which it is accessible by wagon road.

Geology.

The Rawdon hills, in Hants county, form part of a ridge composed of the most northerly zone of the slate division of the gold-bearing series. This zone attains a width of 3 miles and has a general direction of N. 65° E. (magnetic) and on the north side it is unconformably overlain by the lower Carboniferous. The auriferous veins are situated three-fourths of a mile south of its northern limit and on the south limb of the McKay Settlement anticline. The rocks are traversed by numerous faults on the prolongation of an important line of disturbance, called the Mary Lake fault, which has been traced across the country from Cole harbour on the Atlantic coast a distance of 35 miles in a general direction of N. 20° W. The faults at Central Rawdon run more or less parallel and cut the slates almost at right angles, with a thrust and down-throw invariably to the north on the east side.

Character of the Deposits.

There are three important veins, crossing the strata at about right angles to the strike: one known as the Cope lode, another in the immediate vicinity known as the West lode, and the third a fourth of a mile east of these known as the East lode. The Cope lode, which averages 4 feet in width, strikes N. 20° W. and dips east at an angle of 77°; at a depth of 164 feet it dips at a lower angle but soon resumes the original dip of 77°. The lode known as the West lode lies on the west side and strikes S. 11° E. The two fissures in which the West lode and the Cope lode lie converge and from their junction run northword as one, but the two veins remain separate, with broken slate between them, the Cope lode lying against the hanging-wall and the West lode against the foot-wall. The line of junction of the two fissures dips to the south at an angle of 32° for at least 265 feet. The slickensiding and curving of the strata on each side of the Cope lode, and the strike of the strata forming the wedge lying between the Cope lode and the West lode, show that the displacement on the east side of the fissure had been towards the north and downward at an angle of 48°, or that it is what is locally known as a left-hand fault. About the East lode less information is available. It also dips to the east at an angle of 68°.

History.

Central Rawdon is one of the later districts to attract attention, and during 3 years, 1888 to 1890 inclusive, a considerable amount of gold was produced.

Near the last of 1887 a company consisting of Clarence Dimock, Gould Northup, and others was formed to mine the Cope lode which had been discovered a short time previously by James Cope, an Indian. This Com-

[1] Rep. Dept. Mines, Nova Scotia, 1886, p. 19.
[2] Rep. Dept. Mines, Nova Scotia, 1887, p. 29.

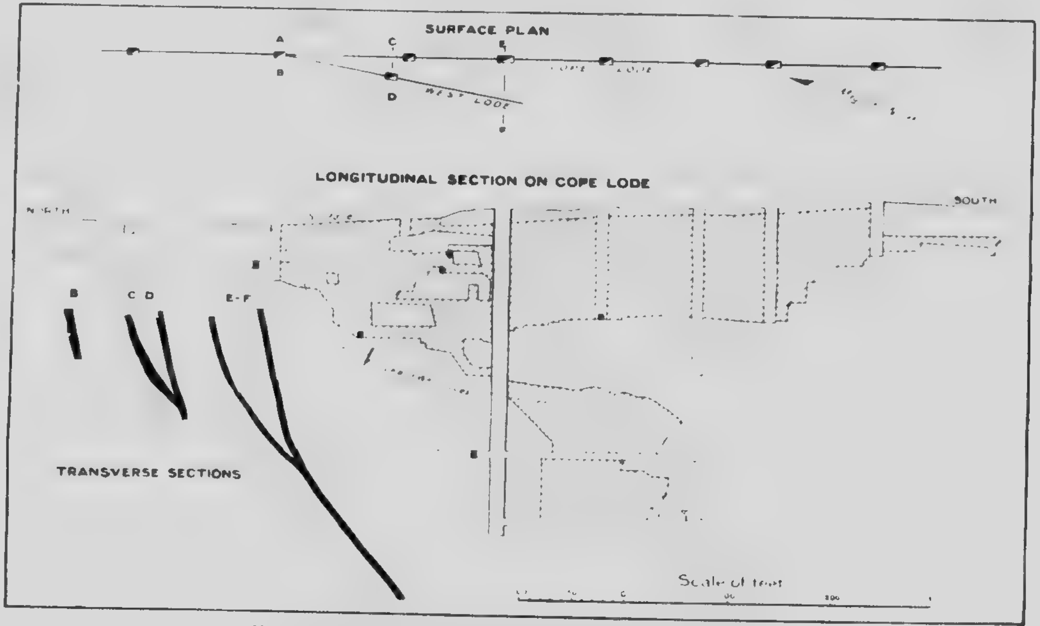


Fig. 3. Workings on Cape and West lodes, Central Rawdon.

pany, known as the Northrup-Dimock Company, erected a 10-stamp mill in 1888 and began crushing in August. Work was carried on so energetically that before the end of the year 375 tons of ore was crushed, yielding 835 ounces of gold. The next year active operations continued and the remarkably satisfactory yield of 2,358 ounces from 925 tons was returned. The property passed into the hands of some Philadelphia capitalists, and Northup and his associates opened up a property east of the old workings on the East vein and erected a 15-stamp mill. In 1890 a good yield was reported from this district and several lots of surface material in addition to quartz were crushed at both mills. This year the Central Rawdon Mining Company, Ltd., and the Northup Mining Company, Ltd., were incorporated, the former to operate the mine on the East lode and the latter to operate the old Northup mine on the Cope and West veins, held for a short time by Philadelphia capitalists. Mr. C. E. Willis was manager for the Northup Mining Company and Mr. Gould Northup for the Central Rawdon Mining Company, Ltd., and for 3 or 4 years small returns were made from the mill of the latter Company.

In 1893 a 5-stamp mill was erected to crush ore from the Withrow property, about 1½ miles southeast of the Northup mine, and in 1894 a small amount of mining and milling was carried on here.

Returns were made by the Northup Gold Mining Company, in 1895, 1896 and 1897, and in 1897 the Company had twenty-eight men employed under the management of E. C. Puttner. There were several shafts on the Cope vein, of which the deepest was over 400 feet. On the Central Rawdon property a tunnel was driven this year in the hillside to cut the East vein and to explore the property and was carried to a length of 450 feet.

After this the district was comparatively idle until 1904 when work on the property was resumed by the Central Rawdon Consolidated Mines, Ltd.; Dr. Cain, manager. The extension of the tunnel was commenced in May and by the end of September the vein was reached at a distance of 926 feet from the mouth. The workings were unwatered, but little mining was done, and 13 ounces were reported in 1906 as a yield from 30 tons.

General Development.

There are five shafts on the Cope lode, the deepest of which was said to be 405 feet in 1897. These are connected by underground levels and the greatest amount of work was done on that portion of the Cope vein extending to the south of its junction with the West lode. Work on the East lode was not so extensive, but a shaft was sunk to a depth of 107 feet. In the tunnel driven in from the foot of the hill no new veins of value were struck, and little use seems to have been made subsequently of the tunnel.

Production of Rawdon (East and Central).

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1887	3,507	13	8	5,302		13	5½
1888	952	15	20	2,760		6	22
1889	2,358	10	0	925	2	10	23
1890	1,899	15	0	1,892	1	0	0
Central Rawdon.							
1891	342	0	0	510		1	8
1896	531	13	0	769		13	23
1897	199	12	0	963		4	3

CHEGOGGIN.

Chegoggin lies 4 miles north of the town of Yarmouth in Yarmouth county.

[1] The rocks consist of grey slates and coarse sandstones, approaching a quartzite in character. Just below these are micaceous staurolitic and hornblende rocks similar to those of Yarmouth. In some places there are well developed crystals of garnet and ilmenite. It is probably the Goldenville formation that is exposed here. The strata dip southeast 45°.

Some very large quartz masses have been found; one of these is not less than 26 paces wide and others are of about the same dimensions.

Some gold had been found in the alluvium of the district, and in 18[illegible] it was thought that the source of this had been found. Prospecting followed, a 10-stamp mill was erected in 1890 and a considerable amount of ore was crushed, but no reliable data as to results could be obtained.

CLAM HARBOUR.

Location.

Clam Harbour is situated on Clam bay, on the Atlantic coast, in Halifax county, 47 miles east of the city of Halifax by post road.

Geology.

The strata of the Goldenville formation here exposed are folded in two anticlines about 500 feet apart, running approximately east and west (magnetic), but slightly converging towards the west and both plunging to the east. At the eastern end of the district the strata between these two folds are plicated into two minor anticlines lying nearer to the south main anticline than to the north one. To the north of the north anticline and to the south of the south anticline the dip reaches at no great distance from the axis an angle of over 60°. A small fault running at right angles to the strata crosses the district and gives a right hand horizontal displacement of some 90 feet at the south anticline, decreasing to only a few feet at the north anticline.

Character of the Deposits.

[2] Both classes of veins are found here, the cross and the interstratified. The latter occur in slate belts lying between heavy beds of quartzite and on the crest of the main anticlines they dip to the east with the rocks and frequently show rolls which also dip to the east. These are the most persistent and most important veins and probably carry all the paying ore deposits. The cross veins, which cross the strata generally in a northeast direction, while probably carrying little gold in themselves, seem to serve as feeders to the other veins. Thus the ore-shoots worked down to 122 feet at No. 1 shaft, just north of the engine house, and the shoot worked to 60 feet, east of the forge, are formed by the intersection of a cross vein with interstratified veins. Further exploration may reveal the presence of other pay-shoots at the intersection of the two different kinds of leads.

Developments go to show that all the interstratified leads so far opened on the apex of the folds have proved auriferous, and this fact might well be taken into consideration by those contemplating further operations in this district.

History and Development.

The district has received scant attention from the mining or investing public The greatest amount of prospecting done here was performed by P. Dunbrack, and mining operations were carried on by Mr. Foster. Several veins have been opened a few hundred feet along their strike and a few shafts have been sunk, but no very extensive operations carried on. Crushing was done in 1904 by means of an arrastre, which consisted of a large circular granite stone revolving in a cast-iron pan.

---

[1] Ann. Rep. Geol. Sur., Can., Vol. IX, 139 M.
[2] Faribault. Geol. Sur., Can., XVI, 330 A.

COCHRANE HILL.

Location.

Cochrane Hill gold district, including the Crows Nest mine, is situated in the northern part of Guysborough county a mile or two southeast of the confluence of the East and West branches of St. Mary river. It lies 10 miles north of the town of Sherbrooke and 30 miles south of Antigonish by the coach road.

Geology.

Of the geology of this district, Faribault writes: [1] "This fold is the sharpest one known in the Province and is much inverted to the south, the north limb dipping north 60° while the south limb is overturned and dips north 75°. The axis plane of the fold should thus dip northerly at an angle of 68°.

"The general course of the anticline at the surface is S. 82° 45′ E (magnetic) and it pitches west at an angle of about 15° or 20°.

"At the Crows Nest mine the anticline was located at a bluff of rock situated immediately east of the mine's road, and half way between the mill and the manager's house, on area 916, block 75. It was traced eastward, up a steep cliff, across Cochrane hill and the main coach road, to Cochrane Hill mine, where it passes at the south corner of the quartz mill and is well exposed 400 feet farther on area 486, block 77.

"The rocks brought up by the upheaval are the quartzose-sandstones and slates of the lower division of the gold-bearing series. The rocks have been subjected to such great pressure that they have become highly schistose and crystalline, holding fine crystals of staurolite andalusite, garnet, and mica. The cleavage is highly developed, while the bedding plane is almost completely obliterated, and consequently, the structure of the anticlinal fold is very difficult to make out."

The sediments in the vicinity are penetrated by numerous granite dykes, varying from 6 feet to less than 1 inch in thickness. Some of these have been observed cutting the veins in the workings of the Belt lead. These granite intrusions have, doubtless, contributed much towards the alteration of the sediments and the metamorphism is equal to any observed elsewhere in the coastal series, producing rocks indistinguishable from those of the Cape Canso peninsula and of Shelburne and Barrington.

Character of the Deposits.

All the gold-bearing veins operated at both mines follow the planes of stratification. Those that have proved productive lie on the south side of the anticline, at a distance from the axis of 200 feet at Crows Nest mine and 3[illegible]0 feet at Cochrane Hill mine and all dip to the north at high angles. At Crows Nest mine, the Stake [illegible] Belt leads are the most important and lie within a width of 6[illegible] Cochrane Hill mine the most attention had been directed to [illegible]t, carrying five veins 1 inch to 4 inches thick, and the Mit[illegible] large low grade deposit 75 feet wide with numerous interbed[illegible]ches to 12 inches thick.

The pay-shoots dip wester[illegible] with the plunge of the anticline and it is thought that they ma[illegible] in the different adjacent veins, towards the north, in a plane parallel to the axial plane of the fold, which dips north 68°. In such case the shoot in any one vein would be found below and to the north of the shoot in the vein immediately to the south. At the Crows Nest mine the pay-shoots on the Stake and Belt leads were found to dip west at an angle of 15° to 20°.

In addition to these main veins [2] **a few quartz veins holding mica are** also met with, especially at the Crows Nest mine, but they generally follow the cleavage plane and invariably cut the bedded veins when they meet. Quartz mined from one of these at the Crows Nest mine is reported to have yielded a little gold, but it is possible that the gold came from the encasing slate belt which holds also an auriferous vein, the Belt lead. These micaceous veins are offshoots from granitic dykes occurring in the

[1] Geol. Sur., Can., Ann. Rep., XV, 413 A.
[2] Faribault. Geo. Sur., Can., Ann. Rep., XV, 413 A.

vicinity and of later origin than the auriferous bedded veins. Regarding the relation of the 'granite veins' and the quartz veins Sir J. W. Dawson says it would seem that the quartz veins cut or disturb those of granite and hence are newer, although there is some reason to believe that all the gold veins are not precisely of one date. From the relations determined in this field and from the fact that 'the gold deposits seem richer in the vicinity of the granite' Dawson feels justified in affirming that the granite intrusions and gold veins are 'roughly contemporaneous.' Faribault, however, claims that recent developments in this district have not borne out Lawson's conclusions. The district is probably one of the best for the study of the relations existing between the granite intrusions and the auriferous veins.

History.

This district, although one of the oldest in the Province, has never ranked as an important producer. Some large bodies of low grade ore are to be found here, but mining has generally been of a very intermittent and desultory nature.

[1] Explorations were made at Cochrane Hill in 1868, several lodes were discovered and a shaft was sunk by Messrs. Cumminger and others. In 1869, a number of lodes were being opened by the Cochrane Hill Company, Kirk & Co., and Mr. McDonald, and a 15-stamp mill, to be run by water power, was erected at Melrose about 2½ miles northwest. After this, little work other than prospecting was done for a number of years. In 1877, 118 tons of ore was crushed, yielding 48 ounces, and for a few years Mr Cumminger and some others did intermittent work. In the nineties work was carried on at different times under the management of such men as A. H. McQuarrie, H. E. Taylor, and H. Hopping. The mine then lay idle for some time, but in recent years it has been held by the California Gold Mining Company. During this time it has been idle a great deal but has been worked occasionally under the management of G. F. Mc-Naughton. In 1907, 560 tons of quartz was crushed yielding 113 ounces, and early in that year operations ceased and the mine was allowed to fill.

Work at Crows Nest did not start so early as at Cochrane Hill, but in 1878 some leads were opened which yielded a pennyweight or two of gold. It seems that little or nothing was done then for several years, but Mr Fraser did some development work in 1885 and 1886, and work continued here intermittently for ten years. After this, work was carried on for five or six years under the management of W. H. Weston.

The veins on which the greatest amount of work has been done are the Mitchell belt at Cochrane Hill and the Stake and Belt leads at Crows Nest. The work consists of open-cuts and underground mining. At Crows Nest the hill is 200 feet high and the deposits were worked by means of adits. A 20-stamp mill and two Wilfley tables were operated at Cochrane Hill and a 20-stamp mill and one Wilfley table at Crows Nest.

General Development.

At neither mine has any considerable depth been reached. At Cochrane Hill mine the greatest depth attained up to 1902 was 125 feet on the Ross lead, and surface developments had extended throughout a length of 1,800 feet. Further development has been carried on since then, and in 1906 the shaft was deepened to 225 feet and levels and cross-cuts were driven. At Crows Nest mine work was carried to a depth of 100 feet and throughout a length of 850 feet. The pay-shoots in the Stake and Belt leads were worked to a fault running southeast, but their continuation on the opposite side of the break was not discovered.

The present developments indicate that the relative position of the gold bearing leads with reference to the anticline is the same at both mines, that the zone of auriferous veins runs nearly parallel with the anticline, at a distance of 200 feet at Crows Nest mine and 300 feet at Cochrane Hill mine, to the south of the axis, and that systematic developments along this zone between the two mines will probably uncover new gold-bearing veins.

The production of this district is included in that of Sherbrooke.

---

[1] Rep. Chief Commissioner of Mines, Nova Scotia, 1868, p. 37.

COUNTRY HARBOUR.

Location.

Country Harbour gold district is situated in the central part of Guysborough county on Country Harbour river and its tributary, Johnson brook. It lies 5 miles south of Country Harbour cross-roads and is reached by coach running from Antigonish on the Intercolonal railway to Isaac Harbour.

Geology.

The Goldenville formation is here exposed and the district lies between a large granite mass on the east and a smaller granite mass to the west, while a short distance to the south and southwest are other large granite masses. The sediments themselves are much intersected by dykes given off from the granitic intrusions. A peculiar feature of the sediments of this district is their general north and south strike, the strata at the Narrows running N. 10° W., and those up Johnson brook a little east of north. The anticline has been located with certainty at two points, namely, at the northwest side of area 1064, where a ledge of quartzite crops out prominently on the northwest side of a small brook, and at the south corner of area 1340, about 200 feet directly west of the Morrison shaft. At both places the anticline shows a decided pitch to the south and on area 1340 a quartz vein can be traced around the apex. Immediately east of the axis the rocks are concealed, but farther east they dip east at a low angle; on the west side they make an abrupt curve and assume a steep dip to the west. This block of gold-bearing rocks is believed to be a part of the Cochrane Hill and Forest Hill anticline, which has been swung through an angle of 90° by the forces that produced the great ault along Country harbour.

Character of the Deposit.

. the veins worked in this district lie in stratification planes, have . general north and south direction, and dip to the west. As the anticline is a pitch to the south the strata and veins approach the apex of the anticline towards the south until they eventually curve around it and assume an easterly dip. The quartz vein which curves around the apex of the fold on area 1340 carries rolls dipping to the south at an angle of 15°. The pay shoots dip south and the shoots of the diff ent veins will probably outcrop along a line approximately parallel with the anticlinal axis.

Among the most important deposits are he Mason belt and the Prince l de up Johnson brook and the Fraser belt immediately east of the river at the Narrows. The last-named is about 5 feet wide and contains three veins: the bull lead on the foot-wall, the 15 inch lead running through the belt, and a small whin-bound lead on the hanging-wall. . ikes N. 10° W. and dips west 58°. The ore shoot on the Mason belt dipped south about 5°, was cut off by a granite dyke, but was not found beyond it. Several other veins have been opened by test pits. Rich drift has been found at different places up Johnson br[illegible] but the thickness of the drift and the abundance of faults and granite [illegible] render prospecting very difficult. All the veins except those in t[illegible] .cinity of the main river fault do not seem to be much displaced by .e intersecting granite dykes, nor does the richness of the pay-shoots appear to be affected.

History.

[1] The discovery which led to this district being proclaimed is attributed to J. Fraser and was made in September, 1861. Nothing was done except a little prospecting until 1868, when a small crusher was built. During the next four or five years a number of lodes were opened and worked intermittently on a small scale. In 1889 some work was done on Johnson brook and a rich discovery was reported.

Activity was greatest in this district during the ni ties, and operations were carried on chiefly on the Mason belt and th Prince lode, the former of which proved quite productive. The two companies that did

[1] Heatherington. Guide to the Gold Fields of Nova Scotia, p. f

the most work were the Country Harbour Gold Mining Company and the Antigonish Gold Mining Company. The latter Company, under the management of J. C. McDonald, worked the Copeland mine until 1895 and operated a 15-stamp mill. The Country Harbour Gold Mining Company worked rather intermittently on the Prince lead. In 1897 some work was being done by the Hopewell Mining Company under the management of J. I. Mason. A few years later the properties of the Country Harbour Gold Mining Company and the Antigonish Gold Mining Company passed into the hands of A. C. Blair and others of St. John and some work was done under the management of Alex. Cameron, but at the time of the inspector's visit in August, 1902, the mines had closed.

Work has been done at different times at the Narrows on the Fraser and other adjacent leads. In 1909, the Sydney Gold Mining Company had twenty-two men employed under M. Shannahan in the McDonald shaft on the Fraser belt, and 455 ounces of gold was recovered from 510 tons of ore. The shaft was sunk 65 feet so that it now has a depth of 145 feet, and drifting was done on the 40 foot and 80 foot levels. A mill building was erected and the following machinery put in

5 Windsor foundry stamps.
5 Truro foundry stamps.
1 100 H.P. Robb boiler.
1 50 H.P. Howell engine.

General Development.

There is little information available on the extent of development work performed in this district. The productive veins lie on the west limb of the anticline and it may be that there is a zone of special enrichment parallel to the axial plane of the anticline. If such be the case then surface explorations on the west side of and parallel with the anticlinal axis may reveal other pay-shoots, and as the axial plane dips east the rich portions of unexposed veins may possibly be found at a lower depth and to the east of those already exploited. Regarding these matters, however, we cannot speak with certainty.

The production of this district is included under the production of Stormont, to be found in the description of Isaac Harbour.

COW BAY.

Location.

Cow Bay mines are situated on the east side of Halifax harbour on the main road to Cow Bay beach.

Geology.

Through this locality runs the line of contact between the Halifax and Goldenville formations and the beds dip to the south at angles varying from 35° to 40°. At the contact lies a belt of grey argillaceous quartzite about 100 feet wide of which some layers are heavily charged with pyrrhotite.

Character of the Deposit.

A great number of veins have been opened crossing the line of contact of the two formations throughout a length of nearly 4 miles, across the peninsula lying between Cole harbour and Halifax harbour. All run north and south, cutting the strata at right angles and dipping vertically. They have been shown to be richest in those portions where they cut the pyrrhotite-bearing belt of rocks, and as these dip to the south at an angle of 35° the problem of keeping in touch with the pay-shoots should present few difficulties. The vein that has received most attention is that once worked by the Evangeline Gold Mining Company, Ltd. It varies much in width, but averages 12 inches, and the productive part, which dips to the south at the same angle as the strata, is said to be 35 feet broad. At 78 feet from the surface in the north shaft a level has been driven to the north 47 feet to a 10 foot belt of hard slate, where the vein turns to the west and decreases in size.

History.

The account of the early history of this district is based almost wholly on information got from an article by F. P. Ronnan in the Industrial Advocate, January, 1900 (Halifax). This ground had received some attention from prospectors, and in August, 1895, D. M. Thompson of Musquodoboit discovered a boulder carrying gold. After considerable trenching he exposed in November a cross vein which was indentified as the source of the boulder. This appeared to Mr. Thompson so promising that in the winter of 1895-6 he erected a 5-stamp water-power mill on Cow Bay river about a fourth of a mile south of his mine. The undertaking seems to have been justified for from June to December, inclusive, 1896, this crusher recovered 321 ounces of gold from 326 tons of quartz.

Thompson's success drew the attention of a number of mining men, and three or four veins were opened up by Messrs. Griswold, Marvin, Noonan, and others. In 1897, a considerable amount of gold was recovered. During this year a number of the properties changed hands. The Griswold areas were sold to Miner T. Foster and the property became known as the Tecumseh. The Marvin and Noonan prospect was sold to Messrs. A. A. Hayward, H. Cooper, and Jack and Bell and a little development work was done. The Thompson areas and mill passed into the control of Halifax capitalists under the name of the Cow Bay Gold Mining Company. Some mining was done here in 1897, but the property was leased in January, 1898 to Charles Putman and Capt. Lar[illegible], who undertook to continue development work. Soon the mine w[illegible]sed and the district lapsed into a period of idleness. About the middle of 1899 the property of the Cow Bay Gold Mining Company was sold by the sheriff to I. W. Horn, who set to work reopening the mine.

Mr. Horn with twelve men continued work here in 1900 for the Evangeline Gold Mining Company, Ltd. The next year the Company was reorganized L. Holland was made manager and efforts were directed towards following the pay-shoot. Work seems to have been discontinued late in 1901 or early in 1902, and little was done until late in 1904 when work was resumed at the Evangeline mine. In 1905 the Cow Bay Syndicate reported a production of 127 ounces from 112 tons, but since then little work has been done here, except in the way of prospecting and testing.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons	Oz.	Dwt.	Gr.
1896	[illegible]	4	12	178	1	6	23
1897	[illegible]	19	19	717		15	15

CRANBERRY HEAD.

The mine known as the Cream Pot is near the shore at Cranberry head about 5 miles north of Chegoggin in Yarmouth county.

[1]The rocks, which are exposed on the shore in high bluffs, are more slaty than at Chegoggin, but the association of quartzite indicates that they belong to the Goldenville formation.

[2]The vein intersects the strata of the micaceous slates at a low angle. It occurs in rolls and varies from 2 inches to 16 inches in thickness.

A discovery was reported in 1868 and the vein appeared so promising that considerable work was done in 1869 and in the early seventies.

[1] Ann. Rep. Geol. Sur., Can., IX, 140 M.
[2] Rep. Dept. Mines, Nova Scotia, 1874, p. 48.

In 1869, an open-cut 600 feet long and 20 feet deep was made and 2 shafts were sunk; in 1870, the shafts were deepened, stoping was done, and 130 ounces of gold recovered from 184 tons of quartz; in 1871 little was done and operations soon ceased for we learn that in 1874 the mine was re-opened. [1] In 1874, the west shaft had attained a depth of 190 feet and the east one a depth of 145 feet, while two others on the vein had a depth of 90 feet and 40 feet respectively. The ground between the first and second shafts had been stoped to within 50 feet of the surface. During the winter of 1874-5, 38 tons of quartz was crushed, yielding 29 ounces, and then operations ceased. In 1897 new machinery was erected and the mine was reopened and worked for two or three years.

EAST RAWDON.

Location.

East Rawdon gold district is situated near the central part of Hants county and is a few miles' drive by wagon road from either Clarkville or Kennetcook station on the Midland branch of the Dominion Atlantic railway running from Windsor to Truro.

Geology.

The Goldenville formation here forms a broad anticline with axis running northeast and southwest and plunging to the northeast. The strata on the south limb dip south at angles varying from 30° to 45° and those on the north limb dip north 40° to 55°.

Character of the Deposit.

The veins follow the stratification planes. They occur on the north limb and have the comparatively low dip corresponding with that of the strata. Towards the east these veins curve towards the apex of the anticline and flatten somewhat. The following leads are crossed as one goes northward from the anticline: Mill (6 inches), Big (36 inches), Richardson (5 inches), Barn (8 inches), No. 1 (7 inches), North (2 veins, 30 inches), Mason McIntosh, and five leads cut in a cross-cut driven to the north.

The veins that have proved most productive lie 600 or 700 feet to the north of the anticline, and well defined rolls occur on some, dipping to the east. Operations have been practically limited to the McIntosh, North, and No. 1 leads and the last is by far the most important one in the district. In this vein the ore occurs in a series of parallel pay-shoots pitching east and separated by barren quartz, and in a shaft 510 feet deep seven different pay-shoots were met.

History.

It was not until late in the history of gold mining in the Province that this district received any attention, and although good results were obtained occasionally, there never has been any great measure of development.

The first time it is mentioned in the Reports of the Department of Mines is in 1884, when Messrs. Sims and White opened a lead 4 to 7 inches thick and a belt carrying several leads from 15 to 25 inches thick. A 10-stamp mill was erected and 241 ounces of gold extracted from 217 tons of ore. In 1885 the Sims or No. 1 lead was opened over a length of 900 feet by Robert McNaughton, and the returns show a yield of 2,759 ounces from 1,173 tons. Some development work was also carried on during this year by Messrs. Thompson, Anderson, and Lantz. In 1886, two mines were worked steadily, the west one under the management of Mr. Dissoway and the east one under the management of Mr. McNaughton. In 1887 both mines continued producing gold and the workings on the McNaughton mine were carried to a depth of 400 feet on a wide lead giving 4 feet of ore. The district ranked first among the producers of the Province, and 3,507 ounces of gold was recovered from 5,305 tons of ore. This

[1] Rep. Dept. Mines, Nova Scotia, 1874, p. 48.

year both properties were sold to the Rawdon United Mining Company and operations were continued under the management of Captain Nicolls until August, when all the buildings connected with the mining industry in this locality were destroyed by fire. In 1890, Barres and McNaughton reported 257 ounces of gold and the following year a small amount was reported, but except for a few ounces in 1908 no returns have since been made. In 1901 the McNaughton mine was unwatered by the Gold Zone Mining Company and it was the intention of the Company to remodel the 25-stamp mill and start mining, but the prospects were apparently not satisfactory.

General Development.

By far the greatest amount of work was done on the No. 1 or Sims lead, and from the west end to the east in a length of 2,000 feet shafts have been sunk to the following depths: 45 feet, 30 feet, 500 feet, 510 feet, 360 feet, 90 feet, 200 feet, 260 feet, 410 feet, 400 feet, and 25 feet. On the north lead, lying a short distance north of No. 1, one shaft was sunk 190 feet and a few others to shallow depths. On the McIntosh, the only other lead that has been mined, shafts have been sunk on the east and to depths of 30, 45, 70, 100, and 30 feet from the west to the east, while at the west end a shaft was sunk 70 feet deep. From this shaft a cross-cut driven 270 feet north intersected five leads, and one driven south 20 feet intersected one lead. None of these have been opened. The operations on the other leads of the district consist chiefly of prospecting pits.

The production of this district is included with that of Central Rawdon.

ECUM SECUM.

Location.

Ecum Secum gold mines are situated in the extreme eastern end of Halifax county, a short distance west of the mouth of Ecum Secum river. Access is obtained either by packet steamer running from Halifax to Port Dufferin or by stage from Shubenacadie station, a distance of 70 miles, to Port Dufferin and thence by post road, a distance of 19 miles.

Geology.

The north limb of the Tangier-Harrigan Cove anticline has at this place been folded into several subordinate crumples. In the developed portion of this district an anticline at the north and a syncline at the south lie 500 feet apart, with two minor intervening undulations. The syncline plunges east 17°.

Character of the Deposit.

The two classes of veins are represented in this district and both have been worked more or less extensively. The two leads that have attracted the most attention are the Cameron and Galena leads. The former is interbedded and carries a vein on each wall. It lies on the south limb of one of the minor folds, and, where an incline shaft was sunk on it, its depth to the syncline is 170 feet. On this lead a great portion of the leg on the south dip has been found auriferous, especially on the curved part near the surface, but that portion of the vein on the anticline immediately to the south, although in thick rolls, does not seem to carry pay ore. At the surface the hanging-wall vein is 6 inches thick and the foot-wall vein is 4 inches. These pinch out at a depth of 130, but come in again on approaching the syncline and show rolls as high as 24 inches and 10 inches in thickness respectively. These were auriferous and were worked on the eastern pitch for a length of over 250 feet.

The Galena vein is a cross vein lying in the trough of the southern syncline with whose axial plane it is coincident. It is 7 inches thick, has gouge on both sides and carries galena and other sulphides.

Another vein that has received some attention is the Pittsburg. Several leads are exposed to the north of the workings on the Cameron both

on the surface and in cross-cuts driven to the north. A number of veins were also cut in the vertical 121 foot shaft sunk near the local anticline just north of the Galena vein.

Three-fourths of a mile west six leads have been cut. One with a foot shaft is 42 inches thick and dips south 60°; another 12 feet south has 2 inches of quartz, and another belt carries four veins 2 inches to 4 inches thick. The rolls here dip east 20°.

On the east side of Ecum Secum inlet a 12 inch vein with rolls dipping west 5° attracted some attention, but no extensive mining was done.

History.

A discovery was reported from this district in 1868, but it was not until in the eighties that mining operations were carried on to any considerable extent.

A great deal of gold was found in the surface boulders during the prospecting in 1868, and in 1869 the Atlantic Company erected a small crusher and did a small amount of mining, which seems not to have proved remunerative. After this some prospecting was done, in 1877 a small lot of quartz was crushed at Tangier, and in 1879 a small lot at Goldenville. In 1880 and 1881 the Pittsburg Company got out some quartz from the property once held by the Atlantic Company. A little mining and considerable prospecting were done in 1889, and again in 1892 an 8-stamp mill was running. In 1894 two shafts were sunk at the Ecum Secum mine by Malcolm Cameron.

In 1899, the property was held by the Westminster Gold Mining Company, C. H. Drillio, manager. In December of this year John E. Hardman reported on the property. He considered the plant of little value. Most of the work had up to this time been done on the Cameron lead. From the old workings 900 tons of quartz had been mined and milled, and this, together with 200 tons taken from veins farther south, had, according to sworn evidence, yielded 11 pennyweights per ton. Hardman recommended a thorough system of development, and in 1900, with Fergus Donovan as manager and C. H. Drillio as foreman, cross-cuts were run north and south from the inclined shaft on the Cameron lead, cutting the Galena lead and others, levels were driven on the Cameron and Galena leads, and a vertical shaft was sunk. In 1902, this mine was in the hands of the Donovan Mining Company, G. H. Gillespie, manager, and C. H. Drillio, foreman. At the time of the inspector's visit the work was confined chiefly to the surface and preparations were being made for putting in machinery. In 1903, this Company sank the vertical shaft still deeper and drove levels on the Galena vein. Later the mine was closed, but was opened again in August, 1906, by the Ecum Secum Gold Field, Ltd., G. H. Gillespie, manager, and from September 1 to June 19 1907, when operations ceased, 456 tons of ore was crushed, yielding 339 ounces of gold. A 10-stamp mill was used.

Some work has been done on a vein on the east side of the harbour near the water The discovery of this vein is attributed to G. C. Armstrong. Some sinking and drifting were done on this vein in 1902 and a 5-stamp mill was erected.

General Development.

The Cameron lead was worked chiefly by means of an incline shaft sunk on the lead. From the bottom of this 170 foot shaft a cross-cut was driven north 186 feet and south 102 feet, the former cutting several interbedded veins and the latter cutting a small anticline, on which the quartz veins of the Cameron lead thicken and form rolls; then farther south a small quartz vein folded in the syncline was cut and at the axis of the syncline the vertical Galena vein.

On the Galena vein extensive operations were conducted and from the cross-cut a level had been driven in 1904; east over 450 feet and west 3[illegible] feet. A second cross-cut was run to this vein from the Cameron lead 2[illegible] feet east of the shaft.

A vertical shaft sunk 232 feet deep near the anticline to cut the Cameron lead intersected several quartz veins and at 120 feet struck the

cross-cut from the Cameron lead. The numerous veins cut were found to vary from a few inches to 3 feet in thickness and some of them were corrugated.

A shaft on the Pittsburg lead was sunk 218 feet east of the vertical shaft and 88 feet south of the cropping of the Cameron lead. This 2 foot lead was found to dip vertically in the shaft, but at a depth of 64 feet it turned in a syncline and came up the shaft so that the two legs of the vein were only 5 feet apart at a depth of 15 feet.

ELMSDALE.

Mining has been carried on to a limited extent on Keyes brook in Halifax county, 2 miles east of Elmsdale station on the Intercolonial railway. The veins are found on the north border of the gold-bearing series in the Goldenville formation. The strata dip south at an angle of about 40°. A number of veins have been prospected, and some sinking and stoping has been done. On one vein two shafts were sunk, one 65 feet and the other 50 feet, and part of a pay-streak dipping west was stoped. [1] The crusher was run by water-power.

FIFTEENMILE BROOK.

Fifteenmile brook is situated in the eastern part of Queens county on the Liverpool-Caledonia road, 4 miles north of Middlefield.

The veins lie on the north limb of an anticline in grey slate with which are found a few beds of quartzite. Although rich drift has been found on the east side of the road the mining done so far is on the west side. Two leads especially have received some attention. The Pitblado lead is of the interstratified type, strikes 63° (magnetic) and dips north 83°. About 250 feet south of this is the Lowe vein, 4 inches wide, striking 76° and dipping south. This is a cross vein but it has a rolled structure, the rolls, however, not carrying gold.

The discovery reported from Middlefield in 1880 is probably that of the quartz veins at Fifteenmile brook. A little prospecting was carried on in the eighties and nineties. In 1901, a shaft was sunk and levels were driven on the Lowe vein; in 1902 a 5-stamp mill was erected and in 1906 C. N. Crowe worked about 2 months, taking out 240 tons, which yielded 54 ounces. A shaft has been sunk 140 feet deep and levels driven. The Pitblado vein has been traced 100 feet on the surface and a 30 foot shaft has been sunk.

FIFTEENMILE STREAM.

Location.

Fifteenmile Stream gold district lies in the eastern end of Halifax county on a branch of East river, Sheet harbour. It is 32 miles from Hopewell, a station on the Intercolonial railway between Truro and New Glasgow, and from this station there is a good wagon road as far as Trafalgar from which place a passable road leads to the mines, 14 miles distant. It is only 15 miles north of East River Sheet harbour, from which a good road runs in half the distance.

Geology.

The plan of the district was published in 1889, and, although later investigations by E. R. Faribault have shown that it is not accurate in every detail, his description of the structure as then known requires little alteration.

[2] "The north anticline of the Moose River mine passes through this district and is here composed of three minor anticlinal folds. The two most northerly folds are only 130 feet apart at the end of the district, on the New Egerton property, and have a pitch to the east at an angle of 30°. The northernmost is well exposed at the west end of the district, on

[1] The Critic, July 19, 1889.
[2] Geol. Sur., Can., X, 110 A.

the east shore of Sheet Harbour river, 100 feet south of the Free Claim lead, where the pitch is to the west at an angle of 18°, but the middle fold could not be located here as the bed-rock does not crop out immediately south of the Free Claim mine. The east and west pitches of the north anticline meet and form a dome a short distance west of the Hudson property, where good ground is most likely to be found.

"The southern anticline is well exposed at the west end of the district on area 905, block 2, 750 feet south of the Free Claim lead, also on the Sheet Harbour Portage road on area 858, block 4. Farther east it passes about 50 feet north of the Halliday lead, beyond which it is thrown to the north, about 150 feet, by a fault, and passes north of the McCuaig lead and south of the Hudson and White leads, prospected here on the eastern pitch of the anticline."

Regarding this southern anticline Faribault reports to the Egerton Syndicate in 1902 that this anticline, if it exists, lies probably a little farther south, at the east end of the district, than is indicated on the published plan. His survey of the old workings of this Company in the same year shows that in this most important part of the district there are three anticlines instead of two as shown on the published plan, that the third lies between the North Serpent workings and the Island and Old Egerton workings. It was discovered in the cross-cut driven 32 feet from the North Serpent workings, half way between the east and west shafts at the depth of 45 feet. The anticline is met here at a distance of 17 feet from the foot of the wall of the Serpent lead, where a lead ½ inch wide curves in the shape of a saddle. These later investigations have thrown some doubt on the existence of a cross fault east of the Walton Doran lead.

Character of the Deposit.

The veins are of the interbedded class and lie in slate beds with whin walls. Nearly all the operations have been limited to veins on the north anticline or northerly groups of anticlines at the east end of the district

In the eastern end of the district the pay-shoots follow the general rule and dip east with the plunge of the folds. Those with pay-shoots dipping to the east are the Old Egerton, McPhee, McGilligan, Island, Serpent, McLean, Walton-Doran, and Jackson. All these except the Jackson were worked on the eastern plunge of three anticlines. The Serpent was small but very rich in the southern syncline. The Orient, Nonpareil, Mother Seigel, and Harvey belts are a group of large belts on the south limb of the southern anticline. These carry rolls and swells dipping west at a low angle produced by numerous angulars striking about the same as the belts. Details regarding the character of all the leads are not available.

[1]The Mother Seigel at the main shaft is 10 to 38 inches thick; and at the face of the west level at the depth of 200 feet, in 1897, there was a body of ore consisting of 3 feet 3 inches solid quartz, 5 feet 5 inches of quartz and slate, and 2 feet 4 inches of slate. The greater part of the ore from this lead appears to have been derived from a very rich roll or swell cropping at the east shaft and dipping west, an exception to the general direction in which the rolls dip in this district.

The Nonpareil is a 10 foot belt carrying several quartz veins from a few inches up to 30 inches wide.

Regarding the Harvey lead, Faribault says [2]"The zone of crumplings forming the Mother Seigel roll dips north at an angle of about 70 degrees and intersects the Harvey belt at a lower level, where it forms a similar roll or swell dipping westward. The eastern portion of this roll has already been worked as far west as the Harvey shaft to the depth of 113 feet, where it can be well observed in the western face of the level. About 75 feet farther west, at the bottom of the vertical shaft, on the 170 foot level, the Harvey belt forms into a large roll showing gold and of promising appearance. This roll is undoubtedly the continuation of that worked to the 113 foot level."

At 96 feet east of the shaft on the McLean lead and on the 100 foot level a cross-cut driven north cut at a distance of 23 feet two promising

[1] Report on the Egerton Gold Mine, W. Pellew Harvey.
[2] Report on the property of the Egerton Syndicate, August 8, 1902.

leads called the Twin leads. These first dip south, then a few feet farther north they curve abruptly within the cross-cut and dip to the north, forming the apex of an anticline. On the south dip they are 3 inches and 6 inches thick, while on the north dip they are 5 and 8 inches, being in rolls on both sides and furnishing about 2 feet of crushing material.

History.

This is one of the oldest gold districts of the Province, but owing to its inaccessibility it has not received the attention it deserves. A discovery was reported in 1867, and for a time work of a desultory nature was carried on, but it was not until during the last two decades that vigorous mining was undertaken.

In 1868 the field looked so promising that the erection of two crushers to be driven by water-power was started, but although they were completed the next year, very little active mining was done. Some very rich drift was found, a large extent of ground prospected, and a number of lodes from 1 inch to 4 feet 6 inches thick were opened on the properties of Messrs. Lyle, Hudson, Cameron, Fish, Chipman, Doran, and Walton. In one place twenty lodes were intersected in a distance of 170 feet. During this year (1869) a few shafts were sunk.

For a few years little except prospecting was done, and although tributers who were working in 1873 expressed their satisfaction with the prospects, little progress could be made on account of the lack of a good crusher.

The Jackson lead received some attention in 1874 and 1875, and was found to carry 16 pennyweights of gold to the ton; stoping was carried on through an extent of 100 feet. The lead was worked again in 1878.

In 1875 the Hall brothers opened the Island lead. Although the difficulty of access to this district made mining almost impossible, these men continued their prospecting for several years and opened a number of veins that have proved rich. In 1879 they opened a curiously contorted lead believed to yield 2 ounces per ton. The same year some promising leads were reported to have been discovered on the Hudson and Greener properties. The Hall brothers were practically the only operators in 1880 and 1881. In 1880, they opened 200 feet of the lode discovered in 1879 and extracted 558 ounces of gold from 191 tons. They also opened five adjoining lodes, the largest of which was the Orient. A 10 stamp mill was in operation. In 1881 in addition to the work done by the Hall brothers, some prospecting was done by Messrs. Grant, Walton, McDonald, and others.

In 1882 the Hall-Anderson Gold Mining Company erected a mill and worked the Serpent and Orient leads. Little work was done on their property the next year until autumn when R. G. McDonald extracted some quartz from the Orient lead. The Company resumed work in 1884 and continued until the summer of 1885.

In 1883 some work was done on areas held by Mr. Grant and the Boston and Halifax Company.

In 1882 James Hudson traced several lodes from the Hall-Anderson property to his, and the next year opened a promising belt 3 feet 6 inches wide. In 1884, other discoveries were made, an engine was put in for hoisting and pumping, and it was hoped that the crusher would soon be in operation. Work continued on this property until 1887, when the mill and hoisting machinery were destroyed by fire.

In 1887 the property of the Hall-Anderson Gold Mining Company was reopened by the Egerton Gold Mining Company and work was carried on steadily until the close of 1889. In January, 1890, the New Egerton Gold Mining Company was incorporated to carry on mining on these areas and work was continued under the management of Jas. A. Fraser. A 15-stamp mill was erected and development and mining were vigorously carried on. In 1890 and 1891, this Company extracted nearly 450 ounces of gold. In 1890 the Stanley Gold Mining Company was incorporated, a 10-stamp mill run by water-power was erected, and active mining was carried on in 1890 and 1891. In 1893 an amalgamation was effected between these two companies. During 1895, 1896, and a part of 1897 mining proved very successful and there was an average yield of 225 ounces per month for 2½ years.

At the time of the inspector's visit in 1896 an air compressor had been put in, a new 30 stamp mill was in course of erection, and sinking, cross-cutting, and stoping were being vigorously carried on on the Nonpareil and Orient leads under the management of G. F. McNaughton. There was a large amount of ore in sight. In 1897 the Nonpareil belt with its 16 feet of milling ore, and the Mother Seigel belt with 15 feet of milling ore, a short distance to the north, were being mined and milled, and care was taken to strengthen the partition of rock between the two which was only 15 to 20 feet thick. Open-cut work was begun in April, 1898, and continued a few months, when it ceased on account of a cave-in, which occurred when the old workings below were reached. Fifty stamps were operated by this Company: 30 run by steam power, and 20 by water.

Work was resumed again in March, 1901, by the Egerton Syndicate, and a new vertical three-compartment shaft was sunk under the management of W. Borlace. This 182 foot shaft was a short distance north of the Harvey and Mother Seigel belts. Little work has been done since then.

General Development.

The published plan of this district, for which the survey was made in 1897, gives some idea of the extent of the operations, but a considerable amount of work has been done since then on the Mother Seigel and Harvey belts as well as on the McLean and adjacent leads.

[1] For the further development of the district Faribault has offered the Egerton Syndicate some important suggestions. He advised that the level on the McLean lead be continued to the east around the apex of the fold where rolls, probably auriferous, would undoubtedly be encountered.

He suggests cross-cutting at different levels to explore ground underlying those veins on which rich pay-shoots were found dipping to the east. Levels should be driven along the leads intersected and tests made to determine the location of the shoots. Such shoots will probably dip to the east at an angle of about 30° corresponding to the plunge of the folds. Those cut on the 100 foot level would crop at the surface some 170 feet to the west and would have a length overhead of about 200 feet. These could be most economically worked from the 100 foot level by overhand stopping.

The zone of crumpling dipping north 70° and producing rolls on Mother Seigel and Harvey belts probably extends into other belts lying to the north of the Harvey belt and forms other large rolls of pay-ore. To tap these, cross-cuts should be driven north from the 170 foot level on the Harvey lead, and it is estimated that 100 feet east of the vertical shaft the crumple will be cut 20 feet north of the Harvey, and that 200 feet east of the shaft it will be cut 40 feet north.

The possibility of developing the ground by means of a deep vertical shaft is considered, and it is estimated that, since the anticlinal axial planes dip north, a vertical shaft, sunk about the lot line between areas 994 and 995, would cut the apex of the north fold at a depth of 150 feet and that of the southerly one at a depth of 575 feet. It is also estimated that such a shaft would cut the Walton-Doran lead at about 600 feet and the rich streak on the New Egerton at 200 feet. From this vertical shaft cross-cuts should be driven every 100 feet and levels driven on the veins intersected.

---

[1] Faribault. Report on the property of the Egerton Syndicate, Au 8, 1902.

Surface plant of the New Egerton Gold Mining Co., Fifteen mile stream

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1883	46	17	14	83	0	11	6
1884	88	14	3	107	0	16	13
1885	424	15	6	898	0	9	4
1886	....			..	..		
1887	398	5	0	829	0	9	15
1888	946	8	0	2,151	0	8	19
1889	786	9	0	1,116	0	11	2
1890	2,305	2	18	3,017	0	15	6
1891	2,356	10	12	4,562	0	12	16
1892	1,236	17	0	2,412	0	12	13
1893 (9 mos. ending Sept. 30)	350	17	0	788	0	8	22
1894 (Year ending Sept. 30)	552	0	0	1,173	0	9	9
1895	2,661	12	0	4,734	0	11	5
1896	3,151	5	0	5,568	0	11	5
1897	2,856	18	0	9,158	0	6	5
1898	537	0	0	3,495	0	4	19

FOREST HILL.

Location.

Forest Hill gold district is situated in the central part of Guysborough county about 6 or 7 miles northeast of Country Harbour gold district. It is 2 miles south of the Salmon River road leading from Country Harbour cross-roads to Guysborough.

Geology.

The gold-bearing series here forms a narrow neck with great granite masses to the north and south from which numerous dykes are intruded into the sediments, which are altered to andalusite, staurolite, and garniferous schists. This district, therefore, affords excellent opportunities for the study of the relation of the granite to the gold-bearing series, and the metamorphic phases of the latter.

The Goldenville formation here forms an anticline the axis of which has a northwest course, gradually curving to the west and southwest and probably finding its continuation in the much disturbed fold of Country Harbour district. On the McConnell property this anticline plunges to the east at an angle of 3°. It is an overturned fold and the strata on the south side dip to the north at angles varying from 70° to 90°. At a distance of 100 feet north of the anticline a syncline has been located, but the covering of drift prevents a study of the structure farther north.

Character of the Deposit.

The productive veins lie on the south limb of the anticline, dipping to the north at high angles. The veins that have proved the most remunerative are the Salmon River, Mill-shaft, Ophir, and Schoolhouse. The thickness of these is indicated on the plan of the district, but these figures do not in all cases represent the total thickness of the ore bodies, as frequently portions of the slate belt adjacent to the vein are found sufficiently auriferous to crush. The Schoolhouse vein is the one that is indicated on the plan as the New lead, but most of the work that has been done on this vein has been done since the plan was published and consists in

the exploiting of the eastern extension of the vein. Underground workings show that this vein is cut by a fault carrying a small quartz vein and dipping at a low angle to the southeast. The slate belt containing the Schoolhouse vein is about 3 feet thick and dips north 72°, but it flattens and thickens on approaching the fault, becoming at the compressor shaft 7 feet thick. Below the fault the belt dips almost vertically and is tilted only slightly to the north. Some of the pay-shoots in this district dip at low angles to the west as in the case of the Ophir lead and the west end of the Salmon River lead. On the other hand, in the eastern end of Salmon River lead and of Schoolhouse lead the pay-shoots dip in the same direction as the plunge of the anticline. In the latter vein zones of barren quartz have been recognized alternating with rich shoots dipping east. In addition to these more important veins, some more or less auriferous veins have been prospected on three different properties one mile farther west, on the south side of Mill lake, where numerous granite dykes follow the stratification planes of the sediments and cut the strata and the interbedded veins in all directions, creating disturbances that render prospecting very difficult.

History.

The history of this district does not extend far into the past. S. D. Hudson discovered the first good looking quartz boulders in June, 1893, and in June, 1894, he and his brother discovered the Ophir lead, and a little later the Mill-shaft lead. Among those who undertook to develop the district were S. D. Hudson and J. C. McDonald. The latter opened two veins, known as the Salmon River and Ophir leads, on areas which were afterwards worked by the Modstock Gold Mining Company. Operations were carried on in 1895, and at the beginning of 1896 a large force of men was engaged getting out quartz for the 10-stamp mill which McDonald had erected. What was only a wilderness in 1894 had by the end of 1896 become an active mining district with three mills, two or three stores, a schoolhouse, and a population of 200 or 300.

Mining operations were very active during the first five or six years of the district's history, then came a period of idleness followed in recent years by a revival of interest and the camp is again the scene of activity. A number of leads have been developed, such as Salmon River, Ophir, New or Schoolhouse, Barrel, Mill-shaft, McConnell, Fraser, Hudson, and Camp.

During the nineties work was carried on chiefly by the Modstock Gold Mining Company and the McConnell Gold Mining Company, the property of the latter Company lying immediately to the east of that of the former. For the first year or two the Salmon River and Ophir leads received the most attention, and operations were then extended to the New or Schoolhouse lead and to a limited degree to a few other veins in the vicinity. The Modstock Company was particularly aggressive and in 1898 had as many as sixty-eight men at work. The management of the mine was for a few years in the hands of W. J. McIntosh and passed later to G. F. McNaughton. It closed in January, 1901, but was reopened in March, 1902, under the management of B. E. Paterson and closed some time later. The McConnell mine was for a considerable time managed by J. McConnell. Among other companies that were working during the nineties may be mentioned E. S. Sweet and Company, and the Phoenix Mining Company.

In 1901 the Strathcona Mining Company was the only one engaged in mining operations in this district, and during this and the succeeding year this Company worked the Schoolhouse lead. Then followed a period of idleness. In 1905 the Modstock Mining Company and the Strathcona Mining Company under the management of J. C. McDonald were engaged in active work on the Schoolhouse lead.

In April, 1907, work was begun by McDonald and Copeland under the management of J. C. McDonald, on the property formerly worked by the Modstock Gold Mining Company. Operations were in progress until the spring of 1909, and during 1908 an average of fifty men were employed. The mine had by no means been exhausted, for from 155 tons of quartz

980 p. 146

Modstock gold mine, Forest Hill

crushed in 1907, 375 ounces of gold was extracted, and from 521 tons crushed in 1908, 1,119 ounces of gold was obtained, while 115 ounces of gold was recovered from 289 tons in 1909.

General Development

No very definite idea of the extent to which operations were carried on can be obtained from the published plan, on which the depths of the different shafts are marked, for it was not until 1895 that any important mining was done, and since the publication of the plan in 1898 important operations have been in progress, more particularly on the School-house lead. A little information is available in the annual reports of the Department of Mines for Nova Scotia for the years 1905 and 1908.

The production of this district is included with others under the heading Stormont, found in the description of Isaac Harbour.

GOLD LAKE.

Gold Lake, or Scraggy Lake, is situated in Halifax county 4 miles south of Moose River Gold mines on the south shore of Gold lake. It lies on the Killag-Goldenville anticline and a few interbedded veins more or less auriferous have been tested. According to the report of the Chief Commissioner of Mines for Nova Scotia, 1867, a discovery had been made here at some earlier time. Numerous quartz blocks are scattered all along the anticline in this locality. A small crusher was once erected here to test the ore, and pits were sunk on several veins.

GOLD RIVER

Location

[1]Gold River district, sometimes called Chester Basin, is situated on Gold river in the county of Lunenburg, one mile above the bridge spanning the stream on the shore road, where it discharges into Chester basin. It is 5 miles north of the town of Chester and 1 mile west of Chester Basin station on the Halifax and Southwestern railway.

Geology.

Owing to the surface being covered with a thick deposit of glacial drift, leaving very few rock exposures, and also owing to the fact that at the time the survey of this district was made there was little mining activity and the workings were consequently inaccessible, great difficulty was experienced in working out the geological structure. Much of our knowledge of the geology is, therefore, dependent on the good sections available along the deep valley of Gold river and on information acquired from men who have worked from time to time in the different mines.

The district lies on an anticline running southwest through Vaughan lake, Maitland forks, and Leipsigate. The anticline is well exposed on Gold river at the Hemlock fall, where it pitches southwest 15°, and its position in other parts of the district was determined by means of the interstratified quartz veins. At the western limit of the district a 6 inch vein opened in a slate belt by N. W. Keddy on area 1076, block 1, curves around the apex of the fold and pitches west 37°; while at the eastern extremity on area 314, block 3, a 5 inch lead discovered by Charles Mills in a wide slate belt just north of the Gammon group of leads curves around the apex of the anticline and pitches east 30°.

"On the south side of the anticline the strata curve abruptly and dip southerly at high angles, increasing rapidly and reaching 85° at a distance of 2,000 feet to the south of the anticline. On the north limb the strata dip at much lower angles and vary from 35° near the axis to 45° at a distance of 1,700 feet northward from it. The axis-plane of the fold dips thus to the north at an angle of 65°, and the upheaval has the form of a much elongated, elliptical dome whose centre is not far east of the bridge spanning the East branch."

[1] Faribault. Geol. Sur., Can., XIV, 219 A.

An important crumple has been observed in a shaft sunk by T. Baker, 500 feet south of the Gammon leads, on the intersection of the Baker and Vermilion veins. The foot-wall of the Vermilion is here folded in a small anticline which runs N. 76° E. and plunges east 31°; and 40 feet to the north is a small syncline, beyond which the rocks assume their general strike towards the northeast.

"The structure of the anticlinal fold has been subjected to much disturbance since the folding and the deposition of the interbedded quartz veins. Unfortunately, the rock exposures are too few and the developments accomplished are yet too limited to determine with any certainty the many faults affecting the district. Several of them run transversely through the anticlinal fold. A left-hand fault has been observed to give a displacement of 75 feet on the North Star lead, and running a little east of south along the west side of a swamp, it crosses the river at Big Cumberland pool and passes west of the Hemlock fall, where the anticline appears to have been shoved 200 or 300 feet, to the north of the Croucher lead. An important left-hand fault appears to have displaced the rocks along the eastern branch, but its direction could not be ascertained. A left-hand fault, giving a shove of some 20 feet on the Croft Hill leads, runs up the river, passes east of the Jumbo crusher, and ... feet east of the 80 foot shaft on the Jumbo lead. A few small faults have also been encountered in the workings of the Captain lead at the east end of the district. There is also probably a left-hand fault of 100 feet or more west of Baker's workings on the North Star lead, and possibly also to the east of them."

Character of the Deposit.

Nearly all the veins worked in this district are of the interstratified class and most of these are found on the south limb of the anticline. They are very persistent along the strike and probably along the dip also. The most striking group of leads so far as size is concerned is the Gammon group, a short distance south of the anticlinal axis, in the eastern end of the district. Seven large quartz veins, aggregating 70 ... in thickness, occur within a distance of 170 feet, and some of these ... be rich enough to form a large low grade deposit. Among the most important leads may be mentioned the Captain, Picayune, North Star, ... Vermilion, Fox, Jumbo, Baker (a cross-vein), Brisco, Hiseler, Croft Hill, ... and Iron. All of these with the exception of the North Star lie on the south limb of the anticline, the North Star lying about 1,500 feet ... of the axis.

"On the northwest side of the anticlinal fold the strata curve ... in a southwesterly direction towards the main anticline and form a ... bulge favourable to the formation of quartz veins. The rock ... exposed along the Gold river, from Innes and Big Cumberland pools to the head of Mosher fall, presents some eighteen interbedded veins situated on this bulge. Some have been tested and found auriferous, but ... have been prospected to any extent." Since the survey of the district a few veins have been discovered between the Croft Hill and Brisco ... on the west side of the river, some of which have been worked by the Chester Basin Gold Syndicate.

Some very rich drift has been found in this district the source of ... has not yet been discovered. The richest was probably that found ... old Touquoy property in the southwestern part of the district, and ... work was done by Damas Touquoy and others to find the vein, but ... float gold quartz was found at the top of drift 20 or 25 feet deep an... have travelled a long distance. In the eastern part of the district highly auriferous drift was found along a swampy depression, and the ... from which it came, designated the Swamp Angel, had not been ... up to 1908, when it was reported to have been found and to be a cross-vein rich at its intersection with some interbedded veins in the vicinity of the Captain lead.

Work in this district is so scattered, and on account of the depth of the drift prospecting has been so difficult that it is impossible to determine the zones of special enrichment. In the eastern end of the d...

and on the southern limb of the fold the rolls and pay-shoots generally dip east at a low angle, but in the North Star vein the rolls and pay-shoots dip west and a rich roll has been worked 600 feet in length and 100 feet in depth. A streak of rich ore was found on the Vermilion lead on the small crumple affecting it, and it is probable that other veins to the north and south will also be enriched at the point where they are affected by the same crumple.

History

Although this is one of the earliest discovered districts of the Province it never rose to the rank of one of the leading producers and has been the scene of a great deal of mismanagement and blundering.

Heatherington says the opening up of the district is due to Mr. Dimock of Chester, who found the first gold in quartz in September, 1861. A prospecting license and some leases were applied for in 1863 and one company had sufficient confidence in the prospects to erect a crusher. The district seems to have attracted little attention and no record is given of mining until 1867 when a few lodes from 3 inches to 6 inches wide were opened by Colonel Briscoe, a shaft was sunk 37 feet, and some trenching done. A crusher was in course of erection this year. The Colonel's operations were suspended in 1868 and only a little other prospecting was done. Then the district seems to have been quite idle until 1879 when a little prospecting was done again.

Then came another long period of idleness. About 1885 Mr. Mills discovered some leads on what is now known as the Jumbo mine and sold to an American company. In 1886 some work was done on this property, and a 20-stamp mill was erected near the confluence of the eastern branch and Gold river. In 1887 some low grade ore was crushed, but the drought compelled the closing of the works, as crushing, hoisting, and pumping were dependent on water-power.

Prospecting was carried on by Chas. Mills, A. Hiseler, and others, and search was made for the Vermilion and Swamp Angel leads, the sources of rich drift. It is said that the Vermilion lead, so called from the colour of the quartz blocks broken from it, was found in 1889, but the Swamp Angel had proved too elusive for the prospectors of Gold River up to 1908 when it was claimed to have been discovered.

About 1887 the Neptune Gold Mining Association was formed and in 1888 had a large quantity of ore blocked out. This year 501 tons of ore was crushed, which yielded 166 ounces of gold, and the crushings dwindled in amount the following years until in 1892 only 93 tons were crushed, yielding [illegible] ounces. The yield for 1893 and 1894 was much better, and at the end of the latter year the Neptune Company's areas and plant were sold to the Lincoln Gold Mining Company.

In 1893 some areas belonging to G. J. Hiseler were sold to the Gold River Mining Company, and this Company during that year recovered 205 ounces of gold from 269 tons of ore.[1]

In 1895, there were four mills with a total of 47 stamps in the district and this year was marked with considerable activity. The Lincoln Company started operations, the Oakdale Company, with B. C. Butterfield as manager, opened three veins among which was the Captain, hoisted a good [illegible] of quartz, and completed a 10-stamp mill. Miner T. Foster and Amos Hiseler carried on prospecting near the river and uncovered some rich looking ore; while T. N. Baker opened a vein with a rich pay-shoot in the northeastern part of the district and milled the ore at a 2-stamp mill that he had erected.

In 1896 the Lincoln mine was operated under the management of D. C. Butterfield, nineteen men were employed, and ore from the Captain and Picayune leads was crushed at the 10-stamp mill. Amos Hiseler had seven men employed on a cross vein, the Verge brothers worked the Oak Tree lead and also opened up the Shattuck lead, and five men were employed at the Baker mine on the North Star lead. The Victor mine, however, was idle.

The next year the Victor mine mill, the Jumbo mine mill, and the Lincoln mine mill were all idle, but G. J. Hiseler had five men working

[1] Industrial Advocate, Nov. 1899, p. 14.

on his property north of the Lincoln mine, while Baker continued operations on the North Star lead. Baker milled some rich quartz in 1898 and was still at work in 1899.

In 1900, returns were made by T. N. Baker, G. J. Hiseler, and Jas. Reeves and in 1901 by T. N. Baker, who from 1895 to 1901 inclusive, reported about 1,587 ounces of gold from 767 tons of ore. Very little mining was done here in 1902, but P. H. Moore had a few men at work in August fitting up the plant at the Lincoln mine, preparatory to pumping out the Captain lead, and A. Hiseler did a little work on the Baker property. In 1903 P. H. Moore did considerable work, and also reported a little crushing in 1905. In 1906 the Vermilion lead received a little attention, but not much gold was reported. Work was continued in 1907 on the Vermilion lead on the Reardon Reeves property, but the principal operations this year were conducted by the Chester Basin Gold Syndicate, A. B. Stewart, manager. This Company started work in September, 1906, on area 835 in the southern part of the district, and two shafts were sunk on a small unnamed lead and another lead to the north of it was opened up. Crushing was done at a 5-stamp mill and a very satisfactory yield was reported in 1907. A dam was constructed across Gold river to furnish power for pumping and hoisting.

In 1908 the Chester Basin Gold Syndicate had twenty men at work, and although 422 ounces of gold was returned the principal work was in the way of development. In June, this Company secured an option on the Vermilion mine and took out about 40 tons of ore, and the Jumbo mine was also unwatered and some small tests were taken out. A small amount of work was done this year on the Hiseler property to the south of the main workings of the Chester Basin Gold Syndicate, and prospecting was carried on in different parts of the district by George Hiseler, P. H. Moore, and others.

The Chester Basin Gold Syndicate had fifteen men employed in 1909 and 307 ounces of gold was recovered from 791 tons of ore. In Decemb . 1908, the Uniacke Mines and Power Company, Ltd., commenced operations on the areas formerly known as the Uniacke or Bank property. Th principal work was done at the east shaft on the Vermilion lead, but th was later discontinued and a fissure or large angular supposed to be the Swamp Angel, 380 feet east of the main works, was mined. The m known as the S. R. Hill mill was repaired, and a Wilfley table was added to the equipment. From 100 tons of ore 87 ounces of gold was recovered

General Development.

There is little definite information available on this point besides what can be obtained from a study of the published plan. The leads which have been worked on the south side of the anticline have had shafts sunk on them as follows:

[1] Jumbo, 80 feet; Vermilion, 40 feet; Captain, several shafts at Victor mine, 200 feet; and at the Lincoln mine 119 feet and 250 feet; P. ayune, 200 and 211 feet; Mill, 100 feet; Fox, 60 feet; Briscoe, 40 feet; Hiseler, 50 feet; Croft Hill, 40 feet; Iron, 40 feet.

In 1906, two shafts were worked on the Vermilion lead each 40 feet d. and the work was confined principally to the east one where levels w driven and some stoping done. In 1907 the west shaft was sunk an additional 35 feet, a level driven east from the bottom 30 feet, and the stoped out between this and the old workings above; while in 1908 the shaft was sunk 30 feet and the east shaft 12 feet. In 1909 the latter continued to a depth of 92 feet and the 80 foot level was extended east a length of 115 feet.

The Chester Basin Gold Syndicate had by the end of 1907 sunk t shafts on their 3 inch lead, the east one 65 feet and the west one 112 f From the bottom of the east shaft levels were driven east 75 feet and west 89 feet, connecting with the west shaft. The stopes in the east level distance of 30 feet east of the shaft were carried to the surface. In 19 a 40 foot winze was sunk from the 100 foot level at a point 80 feet east

[1] Geol. Sur., Can., XIV, 221 A.

the west shaft, and the following year a level was driven east 145 feet, and ground was stoped for a height of 30 feet along its entire length. At a point 33 feet east of the west shaft an incline for hoisting was sunk to the bottom of the winze.

For the development of this district sufficient water-power is available in Gold river and some steps have been taken towards the utilization of this power. A dam giving a 10 foot head of water was constructed by the Chester Basin Gold Syndicate in 1907, and with a turbine 150 horse-power was developed under normal conditions. Other companies have also utilized this river for power in a small way. An excellent water-power could be established at Little or Big Cumberland pool wh re 75 or 100 feet of head could be had from Mosher falls at small cost.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1895 (Year ending Sept. 30).	120	15	0	80	1	10	4
1896	432		3	425	1	0	8
1897	542	[illegible]	5	287	1	17	20
1898	667	13	23	201	3	6	5
1908	474	16	11	712	0	13	8
1909	401	4	0	891	0	9	0

HARRIGAN COVE.

Location.

Harrigan Cove gold district is situated in the southeastern corner of Halifax county, near the Atlantic coast, and just north of the post road. It lies 5 miles east of Port Dufferin, which is reached by packet from Halifax or by stage coach from Shubenacadie, 70 miles distant.

Geology.

The Goldenville formation is here brought up in a broad zone by the Tangier-Harrigan Cove anticline. [1] "A good section of the rocks is well exposed across the district along the area line dividing lot 215 and 216 on the St. Anthony property. It shows that the series have been plicated into one main anticlinal fold, on the south limb of which a subordinate crumple occurs at a distance of 1,100 feet to the south of the axis.

"The main anticline was locat d on area 616, blo k 2, along a small swampy brook running eastward, at a distance of 2,000 feet north of the St. Anthony lead. The fold is broad; the angle of dip increasing gradually on both limbs until it reaches 90° half a mile north of the axis and 40° at a distance of 800 feet to the south of it. . . . .

"At a distance of 1,250 feet south of the main anticline the strata curve in a synclinal, and 150 feet farther, into an anticlinal fold. The two folds converge towards the east and west on area 390, beyond which the crumple terminates.

"The south anticline runs N. 75½° W. and shows prominently 600 feet north of the St. Anthony lead, along a bold ridge for 1,600 feet, beyond which it is concealed by a hill of boulder clay running transversely north and south. On the north limb the strata dip 35°, while on the south the angle of dip increases gradually and reaches 60° at a distance of 1,500 feet south of the axis.

[1] Faribault. Geol. Sur., Can., Rep., XV, 418 A.

"Two left-hand faults were determined crossing the anticline; one, the St. Anthony fault, occurs on the eastern part of area 319, runs S. 25 W. across the auriferous belts, giving a displacement of 90 feet on the anticline; the other passes on area 278, where the throw is 50 feet south, runs southerly, and probably meets the former fault between the St. Anthony and the A. Kent Archibald works. Several important faults undoubtedly occur to the westward, but they have not been made out yet. Some of these probably lie between the main producing portion of the district and Eel brook and have caused considerable displacement toward the left.

Character of the Deposit.

All the veins of this district follow the stratification planes, and all those that were productive lie on the south limb of the southern anticline in an area extending southward from the anticlinal axis 1,600 feet and 2,800 east and west. 'Several large superimposed saddle-veins have been uncovered along the apex of the fold pitching westward at a very low angle. On the north dip they pinch out immediately north of the axis, but on the south limb they extend to a great depth, as is well proved at the surface by the cropping out of a succession of veins extending for a great distance to the south of the axis, the upper portions of which were denuded away to the present surface level.' A vertical shaft sunk on the apex of the fold shows that beneath these superimposed saddle-veins lies a succession of others which have not been exposed on the surface. In the eastern end of the district a few veins have been uncovered on both limbs of the north or main anticline at some distance from the axis, but, although some of them are corrugated and some auriferous drift is reported to have been found in the vicinity, none have proved sufficiently auriferous to warrant development. In the western end of the district a few corrugated veins have been found close to the apex of the north anticline, which at this point plunges to the east, and a 45-foot shaft was sunk on one of these veins. Two veins have also been tested on the west side of Eel brook.

Of the auriferous veins the St. Anthony, also known as the Bishop lead, has proved by far the most productive. This lies about 700 feet south of the axis of the south anticline in a 3 foot belt of slate, half of which was milled along with the 8 inch vein, and a rich pay-shoot dipping west was worked 200 feet in depth and 500 feet in length to the St. Anthony fault, beyond which it was not recovered. This vein has been traced 1,600 feet in length east of the fault; the foot-wall is a bed of whin 30 feet thick, the heavy whin foot-wall being a feature in common with many of the rich veins of the Province. On the Archibald property, which lies to the west of the St. Anthony mine, over 25 belts of veins have been uncovered 300 feet south of the anticline, across 550 feet of strata. Several of these are auriferous and have been mined, the most important of which are the McDonald, Bishop, Slate, and Galena leads. In these the rolls and pay-shoots dip west at a low angle, and lie in a zone running northwest and southeast. In the McDonald lead were found some very fine crystals of gold consisting of a combination of the cube and rhombic dodecahedron. Some distance southeast of the Archibald property lies the McMann property on which two large belts of veins were mined, to a limited depth. Between the St. Anthony lead and the anticline rich drift has been found, and prospecting by means of trenches has revealed several large belts, but none apparently rich enough to warrant operations.

History.

Gold was discovered in this district in 1868, but it was not until the last of the century that mining operations became very active.

In 1872 the Galena and other leads showing free gold were exposed and a mill was erected by a Mr. Smith, but operations ceased early the following year. In 1874, several other leads were found south of the Galena lead, and during the next year a crushing of 15 tons yielded 9 ounces. In 1880 some work was done by Mr. Mott on the South and Slate leads, but although they yielded well operations were for some reason discontinued. In 1899 Thos. Cooper exposed several leads by trenching and did a little

sinking. In 1900 and 1901, Kent Archibald sank shafts on the Iron lead and the Bishop lead which is thought to be a continuation of the lead worked by the St. Anthony Gold Mining Company to be described later. In 1901, a 5-stamp mill was erected. In 1902, Munroe Archibald, who has the work in charge, confined his operations chiefly to the McDonald lead in which some exceedingly rich gold was found. In 1903 and 1904 some sinking, cross-cutting, drifting, and stoping were done. After this the property was held by the Harrigan Cove Gold Mining Company, and under the management of Munroe Archibald the work of cross-cutting and driving levels was continued until some time in 1907, when the mine was closed. Late in the eighties the McMann Bros. erected a 10-stamp mill and did some prospecting in the southern part of the district, and in the early nineties quite a little exploratory work was carried on by Edward Whidden who bonded the mill erected by McMann Bros. Again, in 1900, Mr. McMann crushed some ore from the North lead.

The most productive lead of the district was the Bishop or St. Anthony lead, worked by the St. Anthony Gold Mining Company. Some work was done on this vein in 1899 by J. G. Bishop. This mine was acquired by the St. Anthony Gold Mining Company in February, 1900, and for two or three years operations were actively carried on. During 1900, the output of 200 to 260 tons per month was crushed at McMann's mill, but a 10-stamp mill and a Wilfley concentrator were erected later by the St. Anthony Company. From March to August, 1901, 1,281 tons were crushed, yielding 1,289 ounces. In 1903, this Company tested some leads north of the St. Anthony, chief of which is probably the Mica lead.

During 1903 and 1904 Messrs. Boak and Oland sank a vertical shaft on the apex of the anticline, cutting several saddle veins averaging 9 to 60 inches of quartz without slate within a distance of 109 feet, and at the 100 foot level short cross-cuts were driven to the north and south, intersecting the legs of the same veins.

General Development.

The extent of operations is pretty well indicated by the published plan for which the survey was made in 1902.

Work has been done on the Archibald property since then and the cross-cut started south from the McDonald lead in 1905 had been extended 100 feet in 1906, and its continuation from the McDonald lead northward had been extended 200 feet. In these cross-cuts fifty leads 2 inches to 4 feet wide and nearly all lying in slate beds were cut. A total of 470 feet of drifting had been done on these, but the principal work was limited to the Slate and Galena leads, the face on the former being 255 feet east and on the latter 180 feet east.

Production.

Year.	Gold extracted.			Ore crushed.	Yield of ore per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1899	223	5	3	387	0	11	13
1900	1,705	9	12	1,813	0	18	19
1901	2,628	9	0	3,071	0	17	3
1902	1,564	3	3	3,445	0	8	26
1903	1,091	10	15	1,643	0	13	12
1904	269	3	0	803	0	6	17
1905	15	0	0	65	0	4	15
1906	142	5	0	546	0	5	5
1907	259	5	0	1,267	0	4	2

INDIAN PATH.

The Indian Path mine lies in Lunenburg county on the peninsula lying between Lunenburg bay and Lahave river. It is 5 miles from the town of Lunenburg by a good wagon road.

The veins are found on an anticline in black ferruginous slate of the Halifax formation. The strata of the north limb dip to the north at an angle of 80°, while on the south limb they dip at a very low angle.

The veins are interstratified, contain visible gold, and [1] carry blende, galena, mispickel, and cubical pyrite. Only one vein was worked; it shows rolls and was richest immediately north of the apex of the anticline where it assumed a banded structure and was well mineralized. It was worked to shallow depths, the deepest pit being 35 feet. From the east opening to the west is 1,670 feet and it has been worked about half that length. On the apex of the fold the quartz of the veins is coarsely granular and does not look good.

[2] It is reported that gold was discovered here in 1862, and in the Report of the Chief Commissioner of Mines for 1868 we learn that several veins were discovered by Messrs. Waddilow, that a shaft was sunk 25 feet on one of them, levels were driven, and a crusher to be run by water-power was erected. [3] Some prospecting was done in 1869 and ten or twelve leads varying in width up to 5 feet were exposed; a test of 25 tons of the surface material showed that it could be crushed at a profit of a shilling a ton. Another discovery made this year was that a great deal of gold had been lost the preceding year in the mercury that passed into the tailings. The Messrs. Waddilow continued work of an exploratory character in 1870, and since then there has been a little prospecting and crushing, but the work has been very desultory. [4] In 1876, a little quartz was crushed; in 1884, Lithgow and Archibald erected a 10-stamp mill run by steam power, pumped out the mine and put it in repair, but no crushing was reported; in 1896, A. J. Cowie of Halifax rebuilt the Lithgow and Archibald mill and crushed a few tons, but the results were not encouraging. A little prospecting has been done in more recent years for C. H. Mader.

There may be other veins underlying the one worked, and cross-cutting would probably open their ore-shoots.

Production.

Year.	Tons crushed.	Ore extracted.		
		Oz.	Dwt.	Gr.
1869	187	38	0	10
1870	102	5	18	12
1876	15	3	14	8
1896	26¾	1	19	16

ISAAC HARBOUR.

Location.

Isaac Harbour gold district is situated on Isaac harbour in the county of Guysborough, on the Atlantic coast, and 50 miles by coach road south of Antigonish, a station on the Intercolonial railway. It can also

[1] Hind. Report on Mount Uniacke, Oldham, and Renfrew Gold Districts, p. 58.
[2] Industrial Advocate, V, 5, p. 8.
[3] Report of Chief Commissioner of Mines, 1869, p. 12.
[4] Industrial Advocate, V, 5, p. 8.

Isaacs Harbour, looking up from Victoria lead on the east side

be reached twice a week by packet from Halifax. The Lower Seal Harbour division, of which a description is given here, lies 2 miles east of Isaac harbour.

Geology.

The Goldenville formation is here exposed and has been folded into three anticlines running parallel east and west across Isaac harbour. These are named the north, middle, and south anticlines. [1]"The original structure of the folds has been much disturbed transversely by a great dislocation coming from the northwest and following the Northwest Branch brook to the head of the harbour, as shown on the published plan of Upper Seal Harbour. From the head of the harbour it runs S. 15° E. (magnetic) and passes between Hurricane point and the eastern shore and through Webb cove and Dung cove, giving a horizontal, left-hand throw of some 1,200 feet to the north on each of the three anticlines. Several minor faults have also been determined, branching off in a northeasterly direction from the main harbour fault."

A good section for the study of the structure of the rocks is exposed along the west shore of the harbour from Holly point to Ragged point.

[2]"*Isaac Harbour North Anticline.*—This anticline is well defined at the North Star mine where mining developments show the Grant, Saddle, Little Saddle, McPherson, and Burke leads to curve inside and underneath one another on the archcore of the anticlinal fold and pitch to the west at an angle of 18° from the horizon. On the north leg the strata dip north at angles increasing gradually from 45° on the Grant and Burke leads to 75° at Holly point; while on the south leg the dip increases abruptly to 75°, flattens again and curves in the synclinal fold of the North Star lead, 120 feet south of the anticline.

"In depth, the axis-plane of the fold dips about vertically.

"The course of the anticline is N. 56° W. (magnetic) and that of the syncline is N. 59° W, the folds converging eastward under the harbour; and at Hurricane point, they are only 12 feet apart and form a crumple very favourable to the development of rich auriferous veins conformable with the strata, one of which, the Hurricane Point lead, crops out at the surface and has already been much worked and yielded handsomely. Immediately east of Hurricane point, the crumple is cut off by the main harbour fault and thrown north some 1,200 feet"; it shows on the eastern shore as a flexure, on which are developed rich rolls on the Mulgrave lead.

A fault in the eastern part of the district crosses this anticline and gives the Mulgrave lead a horizontal displacement of 130 feet to the north on the east side and the Mundic lead about 250 feet. This fault runs from area 18, block 2, down Dung Cove brook S. 37° W. to the salt water pond where it intersects the main harbour fault.

Middle Anticline.—Because of the depth of the drift and the lack of mining operations the middle anticline could not be definitely traced. It is concealed on the western side of the harbour, but lies about 500 feet south of the lighthouse and extends west to Country harbour, covered by drift carrying auriferous quartz blocks. On the eastern side of the harbour it runs through Sculpin cove just north of Salmon rock, but at the main harbour fault, a little farther east, it is thrown north 1,200 feet; beyond this it runs west, as far as the Dung Cove Brook fault, where it is thrown north 250 feet, and resumes its course towards the head of Crane pond on Betty brook. The fold is broad and both limbs dip at angles increasing gradually to 65° on the north and 55° on the south.

South Anticline.—This is well exposed at Ragged or Bear Trap point and for a mile farther west along the shore of Country harbour where a few cross-veins were observed. It lies near the south of Red head and at the main harbour fault is thrown 1,000 feet north; it crosses the road at a point where David Buckley developed a flat lead curving over the apex of the fold, but east of this it is heavily drift covered.

[1] Faribault. Geol. Sur., Can., XV, 407 A.
[2] Faribault. Geol. Sur., Can., XV, 408 A.

Character of the Deposits.

The veins are of the interstratified type and the ore is concentrated in shoots, which bear the same intimate relations to the geological structure as is noticed in other districts.

Those deposits found on the northern anticline have received more attention than others. It has been pointed out that the north anticline and syncline converge at Hurricane point and form a crumple along which. The axis-plane of the flexure runs S. 58° E. and dips vertically, while the to be worked profitably. Mining developments show that the paying portions of the veins are of great length, are well defined, and are confined to the crumple The North Star lead has been mined on the western pitch of the north limb of the synclinal fold to a depth of 492 feet, while the others were worked on the western pitch of the anticlinal fold: the Saddle lead 100 feet, the McPherson lead 120 feet, the Burke 258 feet. The Hurricane Point, the North Mulgrave, and the Mulgrave leads have been mined respectively 430, 400, and 2,200 feet in length, and 160, 190, and 20 feet in depth.

The pay-shoot of the Mulgrave lead dips west 12° and it is no doubt the eastern extension of one of the rolls of the Hurricane Point flexure The axis-plane of the flexure runs S. 58 E. and dips vertically, while the veins strike S. 63° E. and dip north 62°. Large rolls of auriferous quartz lie along the intersection of the veins with the axial plane of the flexure

"At the Victoria mine, on the eastern shore of the harbour and 1,500 feet to the north of the Mulgrave, a roll of auriferous quartz, reported to be 10 feet thick and pitching east 35°, has been worked for some 200 feet in length and 105 feet deep. At the Goldfinch mine, 2,100 feet to the southeast of the Victoria mine and 1,380 feet to the north of the Mulgrave lead, a roll of paying quartz, 12 inches thick and pitching east 15°, was mined 300 feet in length and 90 feet deep. It is remarkable that these two rolls, as well as the auriferous drift found on the shore to the northwest of the Victoria and 1,500 feet to the southeast of the Goldfinch mine, are all situated along the same line, running S. 59½° E. and parallel with the Mulgrave line of pay-rolls, but with the differences that on the latter the rolls pitch westward. As the strata strike S. 65° E. the Victoria-Goldfinch line of rolls intersects them at a slight angle, and probably forms a succession of auriferous rolls occurring on certain belts towards the southeast which might prove productive if developed." The deposit at Lower Seal harbour lies in the same line and is possibly produced by the same flexure.

The only important leads on the middle anticline are situated 700 feet north of the axis, and here the Mundic was worked for a length of 700 feet and a depth of 120 feet. A large block of rich quartz was discovered immediately south of the Mundic lead, but its source has not been found

About 1,100 feet south of the middle anticline a rich belt of leads, called the Hattie belt, 21 feet wide, was worked by open-cut on the Gisborne property for a length of 360 feet and a depth of 110 feet, and more recently on the Griffin property. It was traced east 1,400 feet to a fault giving a horizontal displacement of 50 feet. The leads are interbedded and dip south 55° to the depth of 110 feet where the strata curve abruptly in a synclinal fold and the quartz pinches out. To the south of this the strata are shown in a cross-cut to dip north at a low angle with little or no quartz. This is one of the few instances in which rich veins have been found in a syncline in Nova Scotia.

Very rich float was found to the south of this belt and it probably came from another rich vein to the south of the Hattie belt. It also is probable that the rich drift found on Red head is derived from the north limb of the syncline, thrown this far south by the main fault and lying possibly in the vicinity of the McMillan and other belts cut along Sand Cove.

Some prospecting has been done where rich drift was found on the south anticline and at Betty cove, but nothing of importance was found

History.

"Gold was discovered at Isaac Harbour on the 14th day of September, 1861, by Joseph Hynes, under the following circumstances. A young man

by the name of Elias Cook had been at Wine Harbour mining, a short time previously, and had obtained some specimens of gold bearing quartz. On his return to Isaac Harbour he observed a similarity in the rocks at the latter place to those of Wine Harbour, and, in company with Allan McMillan, commenced a search for gold, but found none. At length Cook dropped one of the Wine Harbour specimens, and McMillan in searching picked it up. They immediately returned home with the exciting intelligence that they had discovered gold, upon which a number of the inhabitants at once repaired to the spot; but after a fruitless search of several hours, returned disappointed. Joseph Hynes, however, on the afternoon of the same day, resumed the work of prospecting, and on what is called the 'Free Claim' in the west division obtained several fine specimens of auriferous quartz. On the same evening, John Lathan and others found several pieces of gold-bearing quartz on the Burke lead.

"In the east division the first discovery was made by two Indians, on what is now called the 'Mulgrave lead,' a short time after the discovery on the west side."[1]

In 1862 a number of leads had been more or less mined, the most important being the Mulgrave, Victoria, Burke, and Fraser leads. On the first of these fifteen shafts had been sunk, varying in depth from 15 to 60 feet, the deepest being Gallagher's pit. The average yield from this lead was 1 ounce 13 pennyweights, and the greatest yield 5 ounces 6 pennyweights of gold per ton of quartz. On the Victoria lead there were three shafts from which ore averaging 1 ounce 7 pennyweights per ton had been taken. Work on the Burke lead was limited, but the ore taken out averaged 2 ounces per ton, and 10 tons of quartz taken from the Fraser lead yielded 120 ounces.

Great progress was made in mining in this district in 1863 and the production was four times that of 1862. During this and the succeeding year the quantity of quartz crushed was not great, but it proved very rich. Steady and profitable operations were also carried on during 1865. In 1866 only two lodes were mined, the Mulgrave and the Victoria. The former was worked by Messrs. Gallagher and Co., who sank a shaft 230 feet deep and connected it by a level with a 238 foot shaft 100 feet to the east. Isaac Harbour Company mined the Victoria lode by two shafts 130 feet and 25 feet deep. Work continued during a part of the next year on these two lodes, but in 1868 the production fell to 673 ounces. Early in 1868 work on the Victoria lode was discontinued on account of the loss of the crusher by fire, but the Mulgrave lode was worked by the Mulgrave Company, which had acquired the Gallagher property. The Mulgrave vein although about 6 inches wide was found to swell to about 24 inches at a distance of 1,900 feet from the shore. This … ll, which averaged 2 ounces of gold per ton, pitched to the west and this year it was found near the shore at a depth of 274 feet. Preparations were also made this year to carry on alluvial washing at the mouth of the harbour, where promising alluvial deposits were found.

The production of 1869 was only 227 ounces. The west shaft on the Mulgrave lode was deepened to 320 feet, but mining at this point did not prove a success. Some stoping was done in connexion with No. 3 shaft. Prospecting resulted in the discovery of some lodes north of the Mulgrave; and two shafts were sunk about 900 feet apart on a lode 437 feet south of the Mulgrave. The Mulgrave property passed this year into the hands of Hugh Allan of Montreal. Southeast of the Mulgrave a belt 20 feet wide and containing twenty-one quartz veins 1 inch to 10 inches thick was discovered in September and opened by Mr. Buckley. It was shown to be at least 600 feet long and some rich ore was taken out. On the Gisborne property on this belt preparations were made for erecting a crusher. The alluvial mining was not carried on this year although the ground seemed promising.

The production in 1870 was more than double that of 1869, but mining operations were not conducted on a large scale and it was not until after many years that the production of this district assumed any very noticeable proportions. This year the United Mining Association, Ltd., erected

[1] Report of the Chief Gold Commissioner, 1862, p. 12.

a 15-stamp mill driven by water-power, and in the autumn carried on [illegible]tensive work by open-cut on the belt opened by Mr. Buckley and [illegible] on the plan as the Hattie belt. This Company continued operations on [illegible] belt during 1871, but was troubled for a time by the influx of water [illegible] by a cave-in of the walls of the large open-cut. A tunnel was made [illegible] carry off the water and mining was resumed by means of shafts and levels. This year the same belt was mined by means of shafts and levels by [illegible] Consolidated Mining Company, whose ore was crushed at the mill of [illegible] United Mining Association. These two Companies did some work in [illegible] but in the following year all mining was abandoned and the product [illegible] fell to 37 ounces.

In 1874, work was resumed on areas 983 and 196, block 1, east div[illegible] and Mr. Hattie re-opened the Consolidated Mining Company's mine [illegible] the mill in order, and stoped some ore on the 120 foot level. The next [illegible] some surface material on the property formerly owned by the United M[illegible]ing Association was profitably milled, and tributers met with succ[illegible] mining some stringers in the belt. Another set of tributers did a [illegible] work on the Allan property, principally on a lead 80 feet south [illegible] Mulgrave lead. Work was continued in 1876 on the Union and Con[illegible]dated areas on the south side of the belt, while the North Mulgrave lead [illegible] opened by three shafts on the Allan property on area 4, block 2. Th[illegible] mining in the district in 1877 was on this lead, and this year an adit [illegible] started on the lead from the shore to reach the workings about 300 [illegible] to the east. Work ceased in 1878 owing to lack of agreement amo[illegible] owners, but was resumed in the autumn.

In 1879 work was carried on by Mr. Gallagher on the North M[illegible]grave lode by sinking shafts 80 feet apart and stoping to the west [illegible] quartz was sent to Sherbrooke for treatment both during this y[illegible] 1880, and yielded about 2 ounces per ton. In 1881, this property was [illegible]ferred to the Gallagher Gold Mining Company and preparations wer[illegible] for erecting a 10-stamp mill and carrying on more vigorous operat[illegible]

In 1882 this new mill was running, and mining began. A shaft [illegible] sunk cutting the North Mulgrave lode at 300 feet, and at a depth [illegible] feet a cross-cut was driven to the Gallagher or Mulgrave lode on [illegible] levels were driven and stoping carried on. Operations of a systemat[illegible] vigorous character were continued by the Gallagher Gold Mining C[illegible]pany in 1883 and 1884 and very rich ore was mined. The returns [illegible] latter year were 2,212 ounces of gold from 913 tons of quartz, an[illegible] total returns for this mine were 5,034 ounces from 1,978 tons. Work [illegible] continued in 1885, but on a smaller scale, and in 1886 there wa[illegible] done in the district except some tributing.

Interest was aroused in 1887 by the discovery of a lead show[illegible] quartz on Hurricane island. The lead was opened by three sh[illegible] 70, and 100 feet deep, and during the following year was worked [illegible] Island Mining Company and produced over 2,000 ounces of gold. M[illegible] was actively prosecuted on the island in 1889 by the Palgrave C[illegible] under the management of H. K. Fisher, but owing to litigatio[illegible] ceased in March the following year. In December, 1889, howeve[illegible] was started by H. K. Fisher on the North Star property west of [illegible]bour, and continued during 1890. Important operations were carried on in 1891 under the management of H. K. Fisher, and ore from th[illegible] and North Star lodes was crushed at the mill of the Rockland Gold M[illegible] and Milling Company on the old Gallagher property. A little tribut[illegible] was done on the latter property. Prospectors in the Skunk Den, a small v[illegible] lying in the eastern part of the district, were rewarded late in th[illegible] by the discovery of an auriferous lode, probably a continuation of the Mundic lode.

In 1892, some mining was done at Skunk Den, but the most ex[illegible] work was on the North Star property. This mine was closed for a part of the year, but after a reorganization of the Company it was reopened under the management of Roderick McLeod. At the time of the inspector's visit, thirty men were employed, a new 10 stamp mill was nearly completed, and the main shaft was down 400 feet. Work was continued here in 1893 and two new shafts were opened on new leads. This year the Skunk Den [illegible] Malloy mine was taken over by the Eureka company and worked for a time under the management of W. F. Fancy. The North Star mine was

closed in 1894, but R. McLeod had fourteen men prospecting on the property. Little else was done in the district, the Eureka Company reporting only 31 ounces from 56 tons crushed.

In 1895 six or seven men were engaged in prospecting on the North Star property, and a few men in taking out quartz from the roof of the North Star lead. Late this year the Griffin Gold Mining Company under the management of P. J. Griffin, started operations on the Hattie lead, and in 1896 thirty men were employed, a 10-stamp mill was crushing ore, and 578 ounces of gold was extracted from 1,521 tons of ore. The Eureka Company also made small returns this year. In 1897, the Griffin Gold Mining Company did very little, but some work was done on the Burke lead in the western division by James McLellan.

The year 1898 saw a revival of industry in this district. The Hurricane Point mine was reopened by the Hurricane Point Gold Mining Company under the management of W. F. Fancy. About thirty-six men were employed, and by means of a 10-stamp mill, 1,933 ounces of gold was recovered from 3,025 tons of ore. The Skunk Den mine was also reopened and twenty-seven men were employed by the Economy Mining and Milling Company under the management of C. F. Andrews. The main shaft was 160 feet deep, levels were driven, and some ore taken out for crushing at the 5-stamp mill. The next year mining was conducted on both these properties. At the Economy mine a 10-stamp mill had been erected, fifty men were employed, the main shaft was deepened to 200 feet, and stopes carried 160 feet east and 200 feet west. At Hurricane point forty men were employed and mining was carried on at a depth of 350 feet on a fold pitching west 27°.

In 1900 the Hurricane Point mine had reached a depth of 475 feet where the lead petered out. Some ore was being taken from the roof and the management intended to close the mine soon. The Company had sunk 20 feet on a well mineralized lead 500 feet to the south. In January, Sweet & Co. reopened the old No. 9 Mulgrave mine under the management of F. A. Sweet. The shaft was retimbered and sunk 15 feet deeper, stopes were carried east 50 feet, and from 259 tons of ore 204 ounces of gold was recovered. Returns were made by this Company in 1901 also. In 1902 the Goldfinch lead was worked by the Goldfinch Mining Company under the management of W. F. Fancy, and 846 ounces of gold was extracted from 1,193 tons of ore. Since then this part of the district has received little attention.

Work, however, was resumed by Edgar Silver and other tributers on the Goldfinch property in March, 1909, and continued until July. From 393 tons of ore 288 ounces of gold was recovered.

General Development.

Little definite information is available concerning the development of this district except that shown on the published plan for which surveys were made in 1902. The close dependence of the pay-shoots of these veins already worked on rock structure, as described under the heading 'Character of the Deposits,' makes this a very suitable field for underground exploration by means of a vertical shaft and crosscuts. The crumple on the northern anticline along which the gold was concentrated in the veins exposed at the surface, no doubt extends to some distance in depth, and there is a possibility that this crumple has provided conditions suitable for the concentration of gold in the underlying, unexposed saddle-veins. As yet no other attempt has been made to explore and develop this succession of veins than that made a few years ago by the Hurricane Point Company, when operations were put under way, but were discontinued just as the crumple was being reached and the vein was improving in size and value.

LOWER SEAL HARBOUR.

Geology and Ore Deposits.

This lies about 2 miles east of Isaac Harbour. [1] The Goldenville formation is exposed, the strata striking N. 59° W. and dipping northeast at angles varying from 65° to 73°.

[1] T. G. MacKenzie, Jour. Min. Soc., N.S., XII. p. 86.

The deposit consists of a wide belt of whin and slate, the former predominating, in which are a great number of quartz veins running roughly parallel with the bedding, but frequently cutting across and joining one another to form a great network. Each individual vein appears to have no great extent either in length or depth and the whole series has an echelon arrangement, each one overlapping and lying slightly to the west of the one immediately to the south. In depth a similar arrangement seems to hold, and each vein overlaps and lies a little higher than the one immediately to the south. Operations have been carried on chiefly on the Donkin belt, 27 feet wide, and to a less extent on the Slate and John Bull belts. It has been proved on the Beaver Hat property that the ore-body does not extend to any great depth. On the Partington property to the west the depth has not been proved, but so far as development work shows the ore-body does not appear to diminish in size on the western pitch. The rolls dip west 21° in the Beaver Hat workings and 37° in the Seal Harbour main shaft.

Gold is found in both the quartz and the country rock. Arsenopyrite occurs with a little galena in bunches, chiefly in the slate. Calcite disseminated in small amounts, and in some places a considerable amount of feldspar is found.[1]

As has been already pointed out this deposit lies on the continuation of the Victoria-Goldfinch zone of fissures.

History and Development.

In early years this district atracted attention on account of of rich boulders designated the Golden Stair, and extending from cove to Seal Harbour lake, a distance of 2 miles. Much time was spent in the search for the source of this drift. The prospectors worked on the supposition that the rich vein was a cross vein, since many cross veins were found running north and south, the direction of the line of drift. The most noticeable of these is the 25 foot Pepper and Salt vein. In 1868, and 1869 the search was prosecuted, but without success. Later surface tunnelling was done by Messrs. Penrose and Robert McNaughton and in these explorations McNaughton discovered a cross vein at the head of Seal Harbour lake, after which he erected a crusher and did development work. It was not until October, 1904, that the large belt was discovered, when Percy J. White opened three small leads that had previously been exposed by McNaughton, followed them up and found them to be part of an auriferous belt. White's discovery was followed almost immediately by the discovery of the same ore-body to the west by Partington.

In 1905 two companies were carrying on mining operations, the Beaver Hat Gold Mining Co., Ltd., and the Seal Harbour Mining Co. By the former Company a shaft was sunk 55 feet and at a depth of cross-cuts and short levels driven, and a 5-stamp mill was erected. The Seal Harbour Mining Company, under the management of G. J. Partington, sank a 65 foot shaft a few feet west of the Beaver Hat property, at a depth of 35 feet drove a cross-cut south 87 feet. Another shaft sunk 70 feet west and connected with the cross-cut by a level. A 10-stamp mill and a Wilfley concentrator were erected by this Company.

Operations were active at both mines in 1906. At the Beaver Hat, under the management of S. C. McLean, a three-compartment shaft at the eastern end of the property was sunk 100 feet, and levels were driven, but little stoping was done. The Seal Harbour Mining Company had thirty-five men employed early in the year. The west shaft was deepened to 120 feet, at a depth of 100 feet a cross-cut was driven south and at 27 feet and 47 feet from the shaft in this cross-cut levels were driven. Work ceased in May and the mine was allowed to fill.

At the Beaver Hat mine twenty men were employed in 1907. The 90 foot level was extended and 635 ounces of gold was recovered from tons of ore. A new 10-stamp mill was erected this year. Work was continued to the latter part of May, 1908, when the mine was closed, the production being 624 ounces from 2,670 tons. The 50 foot level was extended east 50 feet and stoping was carried on between this and the foot level.

[1] T. G. MacKenzie, Jour. Min. Soc., N.S., XII, p. 66.

Production of Stormont.[1]

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1862	397	0	0	197		0	[illegible]
1863	1,587	13	12	526		0	[illegible]
1864	1,510	4	21	636		[illegible]	13
1865	1,696	6	2	1,040	1	[illegible]	14
1866	1,274	17	9	2,253	0	11	2
1867	1,266	16	15	782	1	11	[illegible]
1868	673	2	17	596	1	2	11
1869	227	0	13	590	0	[illegible]	16
1870	578	5	15	1,525	0	[illegible]	13
1871	759	7	21	1,937	0	5	18
1872	172	0	11	543	0	17	9
1873	37	18	5	181	0	1	4
1874	167	19	20	236	0	14	5
1875	267	6	18	670	0	8	14
1876	267	0	5	370	0	14	10
1877	240	19	0	96	2	10	4
1878	106	10	0	74	1	[illegible]	19
1879	198	15	0	124	1	[illegible]	6
1880	347	12	0	175	1	19	7
1881	173	10	0	80	2	3	9
1882	903	17	16	571	1	15	7
1883	1,917	3	0	551	3	9	9
1884	2,212	8	1	913	2	8	10
1885	863	15	10	707	1	4	0
1886	435	0	0	429	1	0	6
1887	293	15	22	663	0	8	20 7
1888	2,222	6	0	1,901	1	3	8
1889	1,745	6	0	2,925	0	11	22
1890	616	15	12	1,052	0	11	17
1891	957	3	4	829	1	5	[illegible]
1892	2,482	11	2	3,625	0	13	18
1893 (9 mos. ending Sept 30)	3,451	19	8	7,570	0	9	2
1894 (year ending Sept. 30)..	1,980	4	18	6,628	0	5	23
Corrected returns which were too late for publication give for year ending September 30........	5,402	13	17				
1895	4,225	6	11	16,582	0	5	2
1896	5,076	0	1	22,046	0	4	10
1897	6,209	18	10	28,700	0	0	13
1898	8,386	17	2	34,817	0	[illegible]	16
1899	8,099	1	12	32,794	0	4	22
1900	7,745	18	10	28,238	0	5	11
1901	5,139	17	0	30,228	0	3	10
1902	6,290	1	18	35,903	0	3	13
1903	5,094	1	12	20,531	0	3	1
1904	1,037	8	5	11,767	0	1	18
1905	3,316	6	16	28,882	0	2	7
1906	7,114	9	11	42,431	0	3	8
1907	7,582	10	0	45,627	0	3	8
1908	5,835	15	0	41,793	0	2	19
[illegible]	6,185	15	0	42,617	0	2	21

[1] This comprises Isaac Harbour, Upper Seal Harbour, Lower Seal Harbour, County Harbour, and Forest Hill.

KEMPTVILLE.

Kemptville is situated in Yarmouth county, about 23 miles northeast of the town of Yarmouth.

Little information is available on the geology of the district. According to the map accompanying Part M of Annual Report IX, the Goldenville formation is here exposed, but the text (p. 139) states that the veins lie in greenish arenaceous slates overlying the quartzites. In sketch map accompanying Part Q of Annual Report VI, a belt of grey slates is indicated extending east from Kemptville, but the mines are not marked. The veins cross the strata at various angles.

A little work was done at this place in 1881, and in [1] 1884 Messrs. Ryerson, Cowan, Reeves, and others exposed several veins 4 inches to [illegible] inches wide and traced them several hundred feet. In 1885, the district received quite a little attention, and gave promise of becoming one of the most important west of Halifax, returns for that year showing a production of [2] 624 onces from 133 tons crushed.

The two properties that have received the greatest development are the Kempt and the Cowan properties, the latter being half a mile to the southwest of the former. Little was done at the Cowan mine in 1886, but work was resumed on the 100 foot shaft in 1887. Work at both mines has been rather intermittent and has been interrupted at the Kempt mine by the loss of the mill from fire. Some very rich gold is reported to have been crushed at times but the district has never been an important producer.

A number of shafts have been sunk, some of them over 100 feet deep, levels have been driven, and some cross-cutting done. [3] In 1906, a vertical shaft on No. 1 vein of the Kempt Gold Mining Company, Ltd., had reached a depth of 210 feet; at the 80 foot level 180 feet of cross-cutting had been done; at the 118 foot level drifting had been carried along the vein [illegible] feet, and at the 170 foot level, 75 feet. On No. 2 vein a shaft had been sunk 70 feet and at a depth of 50 feet a level was driven 125 feet. On No. 3 vein a 40 foot shaft had been sunk and a level driven 100 feet, while on No. 4 an 80 foot shaft had been sunk and at a depth of 70 feet a level driven 135 feet. On 'Boreo' lead a shaft had been sunk 90 feet, at the bottom of which a cross-cut had been run 115 feet. There was a 10-stamp mill over the shaft on No. 1 vein and a cyanide plant had been erected.

[4] In 1901, a shaft had been sunk on the Cowan lead 90 feet on a dip southwest at an angle of 80 degrees, and 70 feet deeper at a [illegible] higher angle, making a total depth of 160 feet. At a depth of [illegible] feet a level had been driven 60 feet northeast and from the face of it stoping had been carried to the surface. On the opposite side of the shaft the ore had also been stoped to the surface. At the bottom of the shaft a level had been driven westerly 37 feet, and from its head cross-cuts had been run northerly 160 feet and southerly 50 feet. At 36 feet in the latter cross-cut a large body of ore was struck. This was tapped on the surface 235 feet west from the shaft. The north cross-cut was being driven to intersect a large belt 220 feet to the north. The 15-stamp mill was old-fashioned and was to be remodelled.

[1] Rep. Dept. of Mines, Nova Scotia, 1884.
[2] Rep. Dept. of Mines, Nova Scotia, 1885.
[3] Rep. Dept. of Mines, Nova Scotia, 1906, p. 65.
[4] Rep. Dept. of Mines, Nova Scotia, 1901, p. 66.

Production.

Year	Total yield.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt	Gr.
[illegible]	109	15	5	228	0	9	15
[illegible]	389	17	0	515	0	15	3
[illegible]	205	13	0	411	0	10	0
1904	8	15	0	130	0	1	8
1905	87	16	0	120	0	14	15
1906	8	6	0	60	0	2	18

KILLAG.

Location.

Killag gold district lies in the eastern part of Halifax county on Killag river, a tributary of West River Sheet Harbour. It is 10 miles north of the village of West River Sheet Harbour from which it can be reached by a wagon road. West River Sheet Harbour is reached by packet from Halifax or by stage from Shubenacadie.

Geology.

The Goldenville formation is exposed here in an anticline running S. 79° E. (magnetic). It plunges to the east at a low angle, probably about 25°, like the corrugations in the veins. The strata on the south side of the axis strike east (magnetic) and dip nearly vertically, while the strata on the north side strike S. 55° E. (magnetic) and dip to the north at an angle of 35°. There has been very little faulting of any magnitude. Unfortunately a large portion of the district that it would seem advisable to prospect thoroughly is covered with a swamp, and exploratory work accordingly costs too much to be carried on very extensively.

Character of the Ore Deposits.

The veins are of the interbedded type and follo[illegible]es of stratification around the apex of the anticline. They are [illegible]e larger and more numerous on the apex of the fold than at a d[illegible]om it. Only a few veins have been worked, but productive ore h[illegible]een taken from both sides of the fold. The two veins that have received the most attention are the Flat lead on the north limb and the Stuart lead on the south limb. The Flat lead, 4 inches thick, lies on the hanging-wall of a 4 foot slate belt, and about 10 inches of the slate adjacent to the quartz is auriferous. The vein occurs in rolls dipping east at a low angle and the greater proportion of the gold is confined to the bottom of the rolls. The Stuart lead on the south limb is 10 inches thick and has a dip nearly vertical.

History.

The early history of this district consists of the story of efforts to find the source of very rich drift, efforts which were finally rewarded in G. W. Stuart's discovery of a highly auriferous quartz lead in 18[illegible]r a pertinacious struggle of several years.

[1] During the years 1865-8, quartz boulders were found so rich in gold as to induce Leopold Buckner, who was operating extensively in Waverley, to spend considerable money in an attempt to find the vein. He took in a 10-stamp mill, spent several months in fruitless prospecting, and then took the mill out again without having erected it.

[1] Trans. Min. Soc., Nova Scotia, XI, p. 69.

[1] Late in the seventies or early in the eighties the discovery of m[illegible] rich boulders aroused some excitement and Peter Dunbrack and some associates secured 95 areas. They erected a 5-stamp mill and prospected three years, spending $12,000 without finding the rich vein.

In 1884 these areas were acquired by G. W. Stuart and associates. Mr. Stuart personally managed the operation that finally lead to success. After careful examination of the ground and after considerable surface work he came to the conclusion that the source of the rich drift lay near the centre of the swamp. Several unsuccessful attempts were made to sink in this swamp, but finally by means of caissons Mr. Stuart succeeded in reaching bed-rock after passing through 25 feet of peat, quicksand, and boulders. Continuing the shaft 35 feet in the solid rock, and then cross-cutting 60 feet he discovered in 1889 a 10 inch vein showing an abundance of free gold. This is the vein marked on the published plan as the Stuart lead. A crusher was erected and some ore taken out.

In 1890 the property was sold to a Boston syndicate of which H. S. McKay was president and general manager, and a 10-stamp mill was erected. [2] In December, 1890, 51 ounces of gold was extracted from 45 tons of quartz, and during the first nine months of the following year [illegible] ounces were extracted from 378 tons. In 1894, the work was in charge [illegible] D. S. Turnbull; in 1896 only 20 tons of quartz was milled, but this yielded 123 ounces of gold; in 1897 and 1898 mining was more active and work was done on the Flat and Stuart leads.

In 1897, Robert Hall and others did some prospecting, sank a shaft [illegible] a vein dipping 35°, and drove levels. In 1899, this property, known as the Little Klondike mine, was under the management of A. Clattenburg, and ore was crushed at the mill of H. S. MacKay, whose Company was [illegible] as the Old Provincial Gold Mining Company. The next year the Little Klondike was worked on tribute by Messrs. McPhee and Cox, and since then the district has received little or no attention. In July, 1909, however, work was resumed here for M. J. O'Brien, but up to October it [illegible] limited almost wholly to surface prospecting. At the end of the year the main shaft on the Klondike lead had been pumped out preparatory to commencing underground work.

General Development.

In 1897 the main shaft on the Stuart lead was 176 feet deep, and at this depth levels had been driven east 84 feet and west 169 feet, while a cross-cut driven south 99 feet cut 5 veins from 1 to 10 inches thick, and one driven north 134 feet cut the anticlinal axis at 113 feet, and five veins ranging from a few inches to 10 inches in thickness. A vertical shaft was sunk 115 feet north of the anticlinal axis, cutting the Flat [illegible] a depth of 26 feet. It was then sunk on the dip of the vein, 35 [illegible] depth of 110 feet. Levels were driven east and west 80 feet and quite a little stoping was done.

As much auriferous drift has been found for some distance along the course of the anticline, further prospecting may expose other paying veins. It has also been suggested that a vertical shaft sunk to some considerable depth about 100 feet north of the axis would probably cut a succession of low-dipping veins in those parts where they start to curve around the apex of the fold and where the rolls would be the most numerous and richest.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1891	354	6	16	379	0	18	11
1897	393	19	0	112	3	10	8
1898	556	8	0	355	1	11	8

[1] The Critic, Sept. 27, 1889.
[2] Industrial Advocate, Ap. 1900, p. 14.

LAKE CATCHA.

Location.

Lake Catcha gold district is situated in Halifax county, near the Atlantic coast, on the peninsula between Chezzetcook and Port Petpeswick harbour. It is 6 miles from Musquodoboit harbour, which is reached by stage coach from Halifax, a distance of 31 miles. Since the district is only 2 miles east of the village of East Chezzetcook it was frequently designated Chezzetcook, especially in the early days.

Geology.

[1] The Goldenville formation is exposed in an anticline running N. 71° E. (magnetic) and plunging to the east at an angle of 25° and to the west at an angle of 28°, thus forming an elongated dome. The strata on the south side of the axis dip south at a low angle, increasing to 45° at a distance of 500 feet to the south, while on the north side the dip increases more rapidly and reaches 80° at a distance of 500 feet. Numerous faults cross the district and produce displacements which frequently interfere with mining operations, but the most of them have been accurately located and mapped. Those in the eastern part of the district are left-hand faults, while those in the western part are right-hand. Among the most important may be mentioned a right-hand fault on the Anderson property running northwest and dipping southwest at an angle of 20°, also a prominent right-hand fault in the west end of the district, not accurately located, but probably following Petite Mare brook about N. 25° E.

Character of the Deposits.

The most of the veins lie in the bedding planes, but two cross veins have proved auriferous. All the veins developed lie on the north limb of the anticline, and some of these, like the Coleman, Mill, and Iron leads have been traced over a mile on the strike.

[2] "In looking over the plan of the district, we find that most of the best streaks on the Coleman, Mill, Battery, Lake, and Sheba leads are situated along a well-defined zone. This zone leaves the anticlinal axis at the west end of the district, where rich drift has been discovered northwest of the Petite Mare bridge, on the Cogswell areas, and from there it runs N. 60° E. It, therefore, intersects the veins at an angle of 11°, until at the eastern end of the district it is found 1,400 feet to the north of the axis."

The gold is concentrated in shoots, which have been worked chiefly on the Coleman, Mill, and Battery leads on the Oxford property, and on the Lake and Sheba leads on the John H. Anderson property. The late J. M. Reid, while in charge of the Oxford mine, kept records and plans of the underground workings on the Coleman vein which showed that there are three well-defined pay-shoots in this vein lying in undulations below one another and dipping at low angles.

Two interesting cross-veins have been developed in this district, the Copper and the Cogswell. The former lies 3,000 feet north of the anticline in the northwest part of the district and cuts the bedding in a northeast direction in the manner of an angular, following a slate bed a short distance and then cutting nearly perpendicularly across a bed of quartzite, only to follow a slate bed a short distance on the other side. It varies much in size, reaching 4 feet in places, and the gold and sulphides appear to be concentrated along certain beds of slate. The Cogswell 'angular,' in the eastern part of the district, also has a northeast direction, and is richest at its intersection with interbedded veins.

History.

Although a discovery of gold was reported in 1865, it was not until 1881 that much attention was given to the district. [3] It is claimed that the

[1] Faribault, Geol. Sur., Can., XI, 155 A.
[2] Geol. Sur., Can., Vol. XI, 156 A.
[3] The Critic, Dec. 18, 1891.

discovery that led to results was made by J. H. Anderson, who ope[illegible] several lodes west of Lake Catcha, and who figured prominently in [illegible] history of the district

In 1876 a lead that had been worked 10 years previously was [illegible] opened, and a trial lot of ore crushed at the Lawrencetown mill gave ov[illegible] 1 ounce per ton. A trial lot was crushed at Lawrencetown the next yea[illegible] and another lot in 1879. In 1878 strong interest was taken in some lead[illegible] which, however, failed to justify the hopes of the prospectors. Aurifero[illegible] leads were discovered in 1880 and others were opened in 1881. On J. H Anderson's property seven lodes from 5 to 18 inches thick were open[illegible] and on Dr. Cogswell's property prospecting met with favourable result while on the McLeod property a 4 foot lode was cut in addition to a [illegible] of promising lodes.

In 1882 the Oxford Gold Mining Company had acquired a numb[illegible] of areas north of the lake, erected a 10-stamp mill, and pushed work [illegible] vigorously that it had become established as a steady producer. F[illegible] many years this Company continued steady operations under the ma[illegible] agement of J. M. Reid and made this for a time one of the best produ[illegible] districts of the Province. In 1883 and 1884, operations were confined pr[illegible] cipally to this mine and the yield was good, most of the ore being ta[illegible] from the Mill and Coleman leads on which mining was carried to a d[illegible] of 100 feet. Work continued here during 1885 and 1886, and in 1887 the Battery lead was worked, which although only about 1 inch thick pr[illegible] remarkably rich in coarse gold. The Split lead was rediscovered this y[illegible] and preparations were made to work it; in July an angular was cut on [illegible] property which gave very rich ore on the surface. Ore was taken fr[illegible] Split and Picayune leads in 1888, and a little work was done on the Batt[illegible] lead. The Oxford Gold Mining Company spent most of 1889 in prospect[illegible] Lake Catcha was partly drained and several leads that were never wor[illegible] were rediscovered on the north shore. Other trenching cut numer[illegible] veins. A roll was also discovered on the Coleman lead near the east [illegible] of the property. Returns were made from this mine during the first [illegible] of 1890, but little was done during the autumn. In 1891, thirty-one men w[illegible] employed under the management of J. M. Reid, and the next year twent[illegible] two men were employed. During 1892 and 1893, a large quantity of su[illegible] material was put through their 10-stamp mill in addition to the qu[illegible] from the Coleman lead. Work continued on the Coleman lead in 1894 [illegible] at the end of that year J. M. Reid, who had so ably managed the Oxfo[illegible] mine for 10 years, was forced through ill-health to quit work. In July [illegible] following year he died. A table of the official returns from this mi[illegible] given in the Canadian Mining Manual, 1897, p. 190, as follows:

Year.	Rock crushed.	Gold yield	
	Tons.	Oz.	Dwt.
1882	615	1,017	2
1883	1,472	2,570	15
1884	2,287	2,019	19
1885	1,670	1,094	11
1886	492	1,683	18
1887	886	3,050	2
1888	1,559	2,161	15
1889	767	588	2
1890	901	779	5
1891	2,177	580	8
1892	2,124	764	7
1893	1,646	811	0
1894	1,643	944	18
1895 (6 months)	396	100	16
1896 (3 months)	90	31	10

The history of Lake Catcha district has been to a large degree the history of the Oxford Gold Mining Company, so far as production is concerned, but there have not been wanting earnest and persistent efforts to develop important mining enterprises in other parts of the district.

In 1882, Messrs. Stather, McKay, and Vaughan all made discoveries to the north of the Oxford property, and prospecting was done also by Dr. Cogswell and Messrs. Weston, McLeod, and others. In 1884, preparations were made to build a mill on the Cambridge property to the west of the Oxford property. For several years some prospecting and exploratory work was done on properties adjoining the Oxford property. In 1889 J. H. Anderson did considerable prospecting and commenced development work on one of the many lodes discovered. Some work was done also on the Cogswell and Cambridge areas, the Cambridge mill doing a little crushing. In 1891, Anderson erected a 10-stamp mill west of the lake and got favourable returns from his mining operations. The next year he had twelve men employed on the Lake and Barker leads, and Wm. Carl was engaged in working the Cogswell angular. In 1895, J. H. Anderson employed seventeen men on the Lake lead and a shaft was sunk 100 feet deep. [1] This year or late in 1894 the Oxford Gold Mining Company was incorporated to carry on mining on the property of the old Oxford Company, and G. J. Partington became manager. Crushing was reported from this mine in 1895 and 1896. In 1898 development work was done in the district and some of the old mines were reopened, J. H. Anderson being among those who resumed work. The next year he had twelve men working on the Sheba lead and doing development work north of the shaft. F. W. Hanright also started a shaft a short distance west of the Anderson property on what is supposed to be the Sheba lead.

Some exploratory work was carried on by Messrs. Anthony, Cooper, Hanright, and others and a 15-stamp mill was erected by J. B. Neilly on the Cooper fissure vein north of the district.

Eighteen men were employed in 1900 at the Hanright mine under the management of Mark Anthony. Shafts were sunk on the Sheba lead, some stoping was done, and a few shafts sunk on other leads. Much development work was done and the Cogswell 10-stamp mill was removed and erected on this property. The Oxford Mining Company carried on mining operations on the Twin lead and on another lead 80 feet north of it. This year, J. H. Anderson sank a shaft on the Split lead, and tributers did some work farther west. The next year only a small amount of work was done on the Anderson property; W. Dakeshire sank a shaft on the Sheba lead south of the mill; G. E. Franklyn had a few men prospecting for the Oxford Gold Mining Company, and Mark Anthony continued work with thirty-five men for the Lake Catcha Consolidated Gold Mining Company. The principal work was done on the Mark Anthony lead, where shafts were sunk and some stoping done.

In 1902, J. H. Anderson worked the Split lead; the Fraser angular was picked up by J. H. Johnson who had a bond of the old Cambridge property; and operations were continued on the Hanright property.

Nothing further is recorded of this district in the reports of the Department of Mines, Nova Scotia, until 1907, although operations had not ceased. J. H. Anderson had been working various leads, and in 1907 extracted 166 ounces of gold from 85 tons of ore. Work was resumed on the Hanright property in July, 1907, and mines on the Sheba and Anthony leads were pumped out. The next year tributers reported 219 ounces of gold from 105 tons of quartz taken from the Anderson and Hanright properties. On the Oxford property work was recommenced in August, 1907, under the management of G. J. Partington; the Lake lead was pumped out and some sinking done. In July, 1908, work was commenced by the Oxford Mining Company on the Coleman lead, preparatory to carrying on extensive operations. In 1909 the Pepeswick Mining Company, G. J. Partington, manager, carried on extensive development work on the Lake and Coleman leads, having taken over the Oxford and J. H. Anderson properties. No stoping, however, was done, and the mill was not started.

[1] Can. Min. Manual, 1897, p. 190.

General Development.

The published plan sums up nearly all the available information on this point, giving the location and depth of the various shafts. The new shaft started in 1909 on area 130 about 150 feet south of the old Anderson shaft has been sunk 132 feet, and a level driven 50 feet east. The shaft in the Coleman lead, area 215, was continued to a depth of 485 feet, and at a depth of 460 feet levels have been driven east 132 feet and west [illegible] feet. From this level and from a point just west of the shaft a cross-cut that has been driven south 76 feet intersected the Garden lead at 40 feet and the Whinbound at 65 feet.

There is much good ground still unexplored on the surface along the line of the pay-zone described above. Should an attempt be made to test the depth of the pay-zone it would be well to consider the probability of its dipping at the same angle as the anticlinal axial plane, south 75°, and that cross-cutting at depth should be carried to the south.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton 2,000 lb.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1887	2,959	4	0	601	4	18	[illegible]
1888	2,284	17	3	1,611	1	8	[illegible]
1889	607	10	0	807	0	15	[illegible]
1890	779	5	0	1,008	0	15	[illegible]
1891	800	3	0	2,432	0	6	[illegible]
1892	1,046	18	16	2,467	0	8	[illegible]
1893 (9 mos. ending Sept. 30)	734	10	0	1,361	0	10	[illegible]
1894 (year ending Sept. 30)	1,715	6	0	2,387	0	14	[illegible]
1895	858	15	7	1,501	0	11	[illegible]
1898	396	16	11	406	0	19	[illegible]
1899	678	16	16	1,127	0	12	[illegible]
1900	507	3	6	776	0	13	[illegible]
1901	969	16	21	1,779	0	10	[illegible]
1902	554	8	11	1,037	0	10	[illegible]
1903	472	11	8	677	0	13	[illegible]
1904	113	13	15	97	1	3	[illegible]
1905	64	18	15	56	1	3	[illegible]
1906	231	18	0	282	0	16	[illegible]
1907	177	11	20	90	0	19	[illegible]
1908	219	1	14	106	2	1	[illegible]
1908	5	17	10	(Mortared.)			

LAWRENCETOWN.

Location.

Lawrencetown gold district is situated in Halifax county, at the junction of Partridge and Salmon rivers, near the head of Lawrencetown lake. It lies about 12 miles east of the city of Halifax, from which it is accessible by a good wagon road.

Geology.

The Goldenville formation is brought up by two anticlinal folds, which approach each other in this district and thus give a remarkable width to the auriferous zone. These two folds converge from the east and at the foot of Echo lake are 1,800 feet apart, the most northerly crossing the lake 1,600 feet north of the Mill Brook outlet and the other crossing

this brook 200 feet below the outlet. [1] "The syncline between these two anticlines runs down Echo river to the dam, coalescing towards the west with the southern anticline and terminating on the Shanghai property". "One main fault has been located running down Partridge river in a south-east direction to the Lawrencetown lake, with a horizontal shove to the south of some 200 feet, on the east side of the line; and two other right-hand faults were established to the west, parallel with it, with displacements of about 90 and 17 feet, respectively." Other subordinate faults have been discovered during mining operations and are indicated on the plan of the district.

Character of Deposits.

The auriferous zone is an area over a mile long and nearly half a mile wide. The veins lie in the stratification planes, the most important being the Wadlow, Middle, Bennett, Werner, Nickie, Belt, and Vance. Those that have been developed to the east of Partridge river are situated on opposite sides of the syncline, while the northern auriferous zone west of the river lies at about the meeting of the middle syncline with the south anticline. Another zone including the Belt and Vance leads lies 1,500 feet to the south. The structure of the Belt lead is indicative of a subordinate crumple. Between these two auriferous zones a few veins have been opened

History.

[2] Gold was discovered here by William Brooks in May, 1861. Some years before this he had discovered what he supposed to be gold, but, being ridiculed by his father, he threw the specimen away. When the excitement arose over the discoveries at Tangier he searched near the mill dam where the discarded specimen had been found and succeeded in finding several nuggets of gold. The district was surveyed into lots in 1861.

In 1861 and 1862 some forty distinct veins were opened all of which proved auriferous, and two crushers were erected driven by water-power. These were inferior mills and had to be abandoned later. At Mr. Teare's mill 100 tons of quartz was crushed, but the yield is not known. One lot of 900 pounds yielded 4¾ ounces, and it is estimated that the production for 1862 was 75 ounces.

Some placer mining was tried in 1862, and the drift, which lies from 5 to 20 feet thick on the slope rising to a height of 150 feet on the west side of the river, was tested. In many places gold was obtained by washing the surface gravel, but the value was found to decrease on nearing the bed-rock.

Little else than prospecting was done in this district until 1866, when a Mr. Strange did some sinking and tunnelling and Messrs. Waddilow and Co. opened two lodes 15 feet apart and did some stoping. The next year the Waddilow property passed into the hands of Messrs. Townsend and Co., and several lodes to the east of this were opened by Mr. Werner, shafts were sunk, among which was one 54 feet deep, and some drifting was done. Two mills were erected this year, one by Mr. Werner and one by Messrs. Townsend and Co. Mr. Strange ceased operations on the lodes worked in 1866, and directed his attention to some lodes east of the river, and to some to the west of Townsend and Co.'s areas. [3] Later in the year the Townsend and Strange and other properties were acquired by Messrs. Geo. B. Capel and Carlos Pierce, two promoters representing Montreal capital. The failure of their venture through unskilful and extravagant management did much to hinder the progress of mining in the district.

In 1868, Mr. Strange continued explorations on the east side of the river, but Mr. Werner was the most active operator of the district. He sank three shafts on the Nickie lead, 60, 50, and 40 feet deep respectively, and stoped out a portion of the ground, while a shaft was sunk 54 feet on the 3½ foot mispickel lead to the north and one 55 feet on the Shaw lead a little farther north. The next year this property was worked by the Westminster Gold Mining Company. Considerable progress was made.

[1] Faribault. Geol. Sur., Can., XI, 154 A.
[2] Heatherington. Guide to the Gold Fields of Nova Scotia, p. 39.
[3] Industrial Advocate, Aug. 1899, p. 16.

A new 10-stamp mill was erected, with room for ten more stamps, and [illegible] it was being erected work was continued on the Nickie lead. The dee[illegible] shaft was continued to a depth of 90 feet, the lode was stoped a distanc[illegible] 170 feet, and a new shaft was sunk 62 feet in the centre of a belt [illegible] Notwithstanding these extensive preparations the mine closed down [illegible] in 1870.

After this, mining in this district was almost completely suspended for some time. Some tributers took hold of the Wadlow lead in 187[illegible] made preparations to work it, but little seems to have been done.

Late in 1875, Mr. Crooks started work on the Cross lead, area 291, [illegible] cuts the Crooks lead and continued during the following yea[illegible] Crooks lead, indicated on the plan as the South Slate lead, was the fi[illegible] discovered in this district and is by the roadside near the lower bridg[illegible] The ore was crushed at the Crooks mill by water-power, a mill that [illegible] nally belonged to the Westminster Company, and was moved to a po[illegible] near the sawmill that both might be driven by the same water [illegible] The Cross lead yielded from 1 to 3 ounces per ton. This lead was w[illegible] a little in 1877, and in 1878 Mr. Crooks opened on the east side of [illegible] river the main lead which on the west side is cut by the Cro[illegible] In 1879, Mr. Crooks did a little work on his areas near the bridge an[illegible] following years crushed a few trial lots from different localities.

In 1877, some tributers on J. H. Townsend's property did some [illegible] fitable mining on area 280 or thereabouts on the 'throw' of a large [illegible] but later in the year Mr. Townsend resumed control of his property [illegible] this succeeded a long period of inactivity and with the excepti[illegible] little prospecting nothing was done until the latter part of 1897, [illegible] work was resumed on the Waddilow lead and carried on for abou[illegible] ye[illegible]

In 1899 five men were employed by the Shanghai Gold Mining Com-pany, Ltd., under the management of J. H. Townsend, on the old Waddi-low or Townsend property. The Wadlow lead was reopened and [illegible] crushed at a 3-stamp water-power mill on the property. Work cont[illegible] here in 1900, six men being employed.

Returns were made from this district by Crooks and Townsen[illegible] 1902, by the former in 1903, and by J. C. Mahon in 190[illegible] Some [illegible] was also done here by A. B. Stew[illegible] late in 1905.

General Development.

The extent of the workings is indicated on the plan. On n[illegible] veins were shafts sunk to any great depth, the deepest shaft bein[illegible] 96 feet, and developments do not appear to have been extensive [illegible] to reveal the true character of the deposits.

LEIPSIGATE.

Location.

Leipsigate gold district, also known as Millipsigate, is situa[illegible] Lunenburg county, 3 miles north of the Halifax and Southw[illegible] way, and 6½ miles west of Bridgewater, a flourishing town and [illegible] centre at the head of navigation on Lahave river. It takes [illegible] from Leipsigate lake, a small body of water lying about 225 [illegible] sea level on the headwaters of Petite Rivière.

Geology.

The Goldenville formation, consisting of beds of grey and [illegible] grey quartzite with intercalated beds of bluish and greenish g[illegible] laceous slates, is here exposed in an elliptical dome, of which [illegible] axis runs N. 64° E. (magnetic). The slates of the Halifax forma[illegible] met with about 9,900 feet north and south of the anticline. Th[illegible] of the dome occurs at the western extremity of the district, [illegible] west of Leipsigate lake, about area 57, block 2, and is well exposed on [illegible] rocky knoll on Caribou brook. From this point the axis runs about [illegible] feet north of the mouth of Caribou brook to the outlet of Leip[illegible] at its eastern end. There are numerous rock exposures and the struc[illegible]

[illegible] of the district is, therefore, pretty definitely known. The rocks on the north limb of the fold dip north at angles increasing gradually from [illegible] to 55°, and on the south limb they dip south at angles [illegible] 20 to 30°. The angle formed by the two limbs of the fold is [illegible] about 75° and the axial plane is about vertical. The dome pitches to [illegible] at angles increasing gradually to 30° at the outlet of the lake, while the pitch to the west is a lower angle.

"The only important fault known in the district probably follows a depression between Weagle hill and the Micmac mine and runs in a [illegible]thwesterly direction towards Bird island, giving a right hand [illegible] total displacement of some 400 feet to the Micmac fissure vein. There [illegible] possibly a corresponding left-hand fault following the swamp imm[illegible] [illegible] east of the Crank shaft and Jackpot mines, running in a nort[illegible] [illegible] direction towards South Duck cove and the pond above the dam [illegible] has not been proved.'

Character of the Deposits.

Gold-bearing veins have been discovered at several places around the [illegible] over an area extending about 3 miles long and 1½ miles wide. The [illegible] classes of veins are represented, namely, the cross vein and the in[illegible]bedded vein, but those of the latter class do not attain the size and [illegible]ness of those usually found in the eastern part of the Province. Several have been found, and mining operations have been conducted to a limited extent on a few of them.

All the auriferous veins are on the eastern end of the dome, and the interbedded leads occur along two zones, beginning at the centre of the dome on area 57, block 2, and diverging in a northeasterly and a south-easterly direction on each side of the anticline.

"The northeastern zone is especially well defined. It follows the northern side of the lake and extends to Ernst's Washing lead, a distance of 10,000 feet from the centre of the dome. The following main leads have been opened along this zone, from west to east: the [illegible] lead, worked for several years by the Black Hawk Mining Company to a depth of 265 feet and for 450 feet in length, on a narrow ore-shoot, pitching [illegible] at an angle of 28°, formed at the intersection of a cross-vein with the [illegible] lead; the Green lead opened to a depth of 42 feet; Deal's belt [illegible] prospected; Birch Brook lead, worked 55 feet deep and 300 feet [illegible] [illegible]arfinkel belt of large leads, developed on the surface and on one of which a shaft was sunk to a depth of 48 feet; the Boulder Hill, Me[illegible], Jim Deal, Rusty, Butterfield (32 feet deep), Fox-den, and a few [illegible] small leads have been prospected a little; the Ernst Washing lead [illegible] 50 feet deep), from ¼ to 1 inch thick, in a metalliferous slate belt, is auriferous, and the gold extracted by cradle washings from the drift [illegible] immediately south of the vein is also derived, no doubt, from the vein. Much good ground is still completely undeveloped along this zone, [illegible] especially between the Black Hawk and Birch Brook leads, [illegible] as far east as the [illegible] hill where a great many large blocks [illegible] have been observed, strewn over the surface.

"The southeastern zone of main leads is not so well defined as th[illegible] [illegible], but it follows in a general way the southern side of the [illegible] [illegible] extends probably about the same distance eastward from the [illegible] [illegible] dome. The principal leads opened along this zone are of th[illegible] [illegible] (60 feet), Stillwater, Twin, Waterman (48 feet), Aulenbac[illegible] [illegible] [illegible] (90 feet), Bluff (255 feet), Quigley (20 feet), Rose (40 feet), Johns[illegible] [illegible] Island (20 feet), Joe Zink (10 feet), Greenwood and Lacey (2[illegible] [illegible] deep). The rich pay-streak, worked to a depth of 255 feet on the Bluff lead, is a well defined ore-shoot, 8 feet long measured horizontally, [illegible] at the intersection of angling veins or 'angulars' from the north [illegible] with a small main lead and reported to be still as good at that depth as it was above. Rich ore was mined 40 feet deep on the western end of the Rose lead, where it is cut off by a small fault on the western [illegible] of a swamp, and gold values were developed at a few other points [illegible] its course for a length of 1,300 feet.'

[1] Faribault, Geol. Sur., Can., XVI, 323 A.
[2] Faribault, Geol. Sur., Can., XVI, 323 A.

A great many veins have been observed cutting the strata at va[illegible] angles, and these are generally composed of barren, white quartz, alth[illegible] a few on the north side of the lake carry sulphides and are auri[illegible] A great number occur at the eastern end of the district near the [illegible] of the lake, where they run at right angles to the anticlinal axi[illegible] have the same strike as the strata, but dip west at angles of 50° t[illegible] They do not appear to be auriferous.

'Small angling veins or "angulars," branching off from or ru[illegible] into main leads and sometimes causing enrichments in the form of [illegible] shoots, have already been referred to in the case of the Bluff and B[illegible] Hawk mines. They are generally barren of gold, but they appear [illegible] the smaller ramifications of the main channels conveying the solu[illegible] into main leads where a deviation or a check to the flowage prod[illegible] concentration of minerals by precipitation.'

The vein that has attracted most attention in this district an[illegible] produced the great proportion of the gold is the Leipsigate, a cr[illegible] fissure vein lying on the south limb of the dome, striking at a sligh[illegible] with the strike of the strata and dipping to the north towards th[illegible] cline and in a direction opposite to the dip of the strata. It l[illegible] feet south of the lake, and is believed to consist of three different s[illegible] separated by faults and aggregating 9,000 feet in length. It has opened in these three sections throughout a length of 4,350 feet

The western section lies west of Mud lake, 3,200 feet south [illegible] anticline, and has been opened 800 feet along its course by two shaft[illegible] Duffy shaft, 95 feet deep, and the Dr. Cowie shaft, 25 feet deep. The [illegible] strikes here N. 83° 30′ E. (magnetic) and dips north 50°, while th[illegible] strike N. 54° E. and dip south 49°. The width of the vein varies fro[illegible] few inches up to 2 feet and appears to be made up of small ang[illegible] coming from the northwest and dipping northeast at angles averagi[illegible] The vein has not been traced westward from the Cowie shaft, but [illegible] doubtedly continued in that direction and may follow a swampy dep[illegible] sion running west to the eastern end of Caribou lake

The Gilmour shaft on the middle section is 800 feet east of the D[illegible] shaft, and between the two the vein is concealed by low swamp[illegible] and Mud lake. A small fault may lie in this area not produ[illegible] horizontal displacement, but accounting for the difference in th[illegible] of the western and middle sections of the vein. From the Gilm[illegible] the middle section has been traced 2,000 feet on a strike of N. 6[illegible] (magnetic). It dips north at an angle of 70° at the surface, bu[illegible] at a depth of 180 feet in the Gilmour shaft. The opening farth[illegible] on the middle section is 15 feet deep and is on area 402, block 5, [illegible] east of the Bear Trap road; the vein is 6 inches thick at this p[illegible]

From this opening eastward, for 2,930 feet to the Micmac main [illegible] the country is low, swampy, and flooded by several runs of Me[illegible] stream. Some rich float found at the north end of Weagle hill [illegible] doubt from this concealed portion of the vein, and it is report[illegible] several attempts to cut the vein have proved unsuccessful, althou[illegible] local miners expressed the opinion that it was probably cut s[illegible] ago on the north side of the brook, about the north end of area 4[illegible] 4. If the middle section of the vein maintains its course thro[illegible] low ground, then there must be a right-hand fault producing a [illegible] tal displacement of 400 feet between the middle and eastern [illegible] Judging from the surface features and the position of the fl[illegible] south of the vein, the fault probably runs N. 30° W. along a [illegible] lying east of Weagle hill and Bird island, and 250 feet west of W[illegible] store. Information received since the publication of the plan p[illegible] series of faults in this vicinity.

The eastern section of the vein has been developed for a [illegible] 1,600 feet. The western end of this section strikes N. 57° E. [illegible] for the first 700 feet, and dips north at an angle of 70° to 60 [illegible] it divides into two branches, the Crank shaft vein running N. 53 [illegible] dipping north 70°, and the Jackpot vein curving gradually [illegible] until it runs N. 21° E. to the edge of a swamp where it is co[illegible]

Regarding the character of these ore-shoots in this vein there [illegible] be a lack of harmony in the opinions of those who have given [illegible] tion study.

Concerning the western section of the Duffy shaft Faribault [illegible] that, as the intersection of the fissure with the strata as well as with the angulars dips east, the ore-shoots may be expected to dip in the same direction. He also states that developments in the middle section at the Gilmour shaft show that the ore-shoots dip east at low angles, occurring at the intersection of the vein with certain strata of soft rock which are more favourable to fracturing and the infiltration and deposition of gold. From the Gilmour shaft, levels have been run developing four distinct and well defined ore-shoots reported to average 24 inches of crushing material and dipping east at an angle of 17°. Regarding the eastern section of the vein on the Micmac property he says that developments to the west of the main shaft in the Micmac mine show that the [illegible] ore lies in shoots, lying along the intersection of the vein and the [illegible] strata, and that these shoots dip east at low angles. [illegible] however, the pay-ore occurs in irregular bodies with a tendency to [illegible] west at about 75°, and possibly coincides with the branching of [illegible] fissure, which occurs at the eastern end of the workings. In the [illegible] branch of the fissure, shoots were reported to dip west at angles varying from 15° to 75° and to go to a depth of 180 feet at the [illegible] and 250 feet at the Jackpot mine. These shoots are probably formed at the intersection of the main vein with angulars.

In a report on the Micmac mine dated Boston, April 3, 1901, W. [illegible] [illegible]sby states that the crevice in which the vein lies is not perfectly [illegible] and that the hanging-wall has evidently slipped down at least 15 or 20 feet relatively to the foot-wall, so that the opposing walls no longer correspond. "The result is a series of lenses or wide parts of the vein alternating with narrow parts or "pinches." The lenses, or shoots of ore as they may well be called, often begin and end quite abruptly and [illegible] regular intervals. They are generally continuous downward [illegible] from 10 to 20 feet, but in some cases only from 3 to 5 feet; and they all without exception, show a general inclination or pitch to the [illegible] of about 1 foot in 8, due to the fact that the strike of the [illegible] [illegible]lel with the strike of the strata. These shoots of ore vary [illegible] commonly from 1 to 8 feet, averaging, perhaps, 2 [illegible] 3 feet, while the pinches between the shoots range mostly from [illegible] in thickness, averaging, perhaps, 6 inches." Calculating [illegible] production of ore and the number of square feet [illegible] out he concludes that the average thickness of the [illegible] portion was [illegible] less than 18 inches.

Forbes Rickard in a report on the Micmac property says: "The vein [illegible] is quartz with a sprinkling of arsenical pyrite [illegible] sufficient for mill concentration. There is a [illegible] of secondary lime carbonate with the richer parts of [illegible].

"The main fissure vein of the Micmac and Le[illegible] central gouge, and in other respects bears indisputable evidence of [illegible] [illegible] fracturing which has resulted in the formation [illegible] sets of [illegible]lapping quartz lenses.

"The first fissuring seems to have been filled with a white quartz, which in the Crank shaft and in some of the eastern workings opens out to 6 and 7 feet width of relatively poor quartz. The [illegible] along nearly the same fissure line seems to have resulted in bluish quartz and altered country rock.

"The reopening of the fissure has been the cause of an enrichment of the original vein or quartz deposit, which enrichment takes the form of very rich but inextensive patches of gold quartz. Thus there has resulted a compound fissuring which makes a workable and payable deposit of two sets of lenses, either of which, taken separately, would have been unprofitable to extensive operations."

Rickard observed a relation between the rock structure and the direction of the ore shoots, but claims that the ore-shoots instead of being dependent on the intersection of the vein with certain strata, are determined by the direction of the displacement in the fissure itself, a displacement which has been repeated in this instance so as to form overlapping lenses having a different trend.

[1] Geol. Sur., Can., XVI, 328 A.

History.

Attention was directed to this district in the eighties, but it was not until late in the nineties that mining was carried on, on an extensive sc...

The report of the Department of Mines, N.S., for 1883, states that a considerable amount of gold had been recovered by hand from a cross vein discovered by Mr. Owen on Leipsigate lake, and that Messrs. H... and Owen had also found a promising lode on the north side of the lake. This lode averaged 20 inches of milling ore and had been traced a distance of 600 feet. In 1884 a 10-stamp mill had been built and Messrs. Hall and Owen returned a yield of 410 ounces from 130 tons crushed.

For a number of years after this there seems to have been littl... mining. Some Germans of Minneapolis organized a company known a... the Duluth Gold Mining Company to work a vein south of the lake, the middle section of the Leipsigate vein; and in 1886 a Wiswell mil... erected, but the Company apparently met with no success. From ... to 1892, inclusive, small returns were made by the Millipsigate Gold M...ing Company, and in 1896 by Cashon and Hines.

The latter company carried on operations and made fair returns for 4 or 5 years from the mine now known as the Micmac. In 1898 the Cashon-Hines mine was worked under the management of Capt. John Hines, who had thirty men employed on the vein south of the lake. At the time of the inspector's visit, there were three shafts on this property; the mill shaft 172 feet deep, and two shafts about 700 feet southw... the mill shaft 100 feet and 200 feet deep. Drifting and stoping were being carried on. The Owen Gold Mining Company worked steadily during the year at the Jackpot, north of the Cashon-Hines mine, on ... was thought to be a continuation of the same lead, which was believed to curve northward, and the ore was crushed at a 5-stamp mill.

In 1869, mining was vigorously conducted at the Cashon-Hines ... under the management of Capt. Hines, and the ore was crushed ... 10-stamp mill. Work was also continued at the Owen mine under th... management of John Lacey, although the mine was closed for a... on account of the difficulty of coping with the water. Some prosp... was done during the year by David McKay north of the Owen mine. Both the Owen and the Cashon-Hines mines made returns in 1900.

The Cashon-Hines property was then acquired by the Micmac Gold Mining Company. This Company commenced work on April 15, 1900, under the management of T. W. Moore, and returns were made every year until 1908, the largest being in 1905, when a yield of 2,239 ounc... gold and 102 ounces of silver was obtained from 5,503 tons of ore. From 1901 to 1908 inclusive, this Company reported about 9,650 ounces of ... from 30,000 tons of ore. Mining was actively carried on, and in 1903 ... main shaft was 370 feet deep. This year a new shaft house was built and a new boiler and an air compressor put in. A cyanide plant consisting of four treatment vats for tailings was set in operation in February, and the treatment was carried on with apparent success under the management of H. S. Badger. The capacity of the plant was 50 tons per day and stock was taken from the old tailings beds as well as from the plates. The plant was erected at a cost of $5,000, and in 1903, 5,104 tons of stock valued at $3 78 per ton was treated, and an extraction of 74·9 per cent, equalling $2.83 per ton, was made. The cost of producing this was $1.05 per ton divided as follows:

Labour for charging tanks..	$0 26
" discharging tanks..	0 09
Technical staff, including management..	0 34
Cost of chemicals..	0 33
Time for precipitation..	0 03
Total cost per ton..	$1 05

The treatment of stock from old beds, which was about half of the total stock treated, considerably increased the cost as well as lowered the percentage of extraction. Some tests were made this year by C. D. Maze as to the applicability of the bromo-cyanide process.

Surface plant, Micmac gold mine, Leipsigate.

p. 174

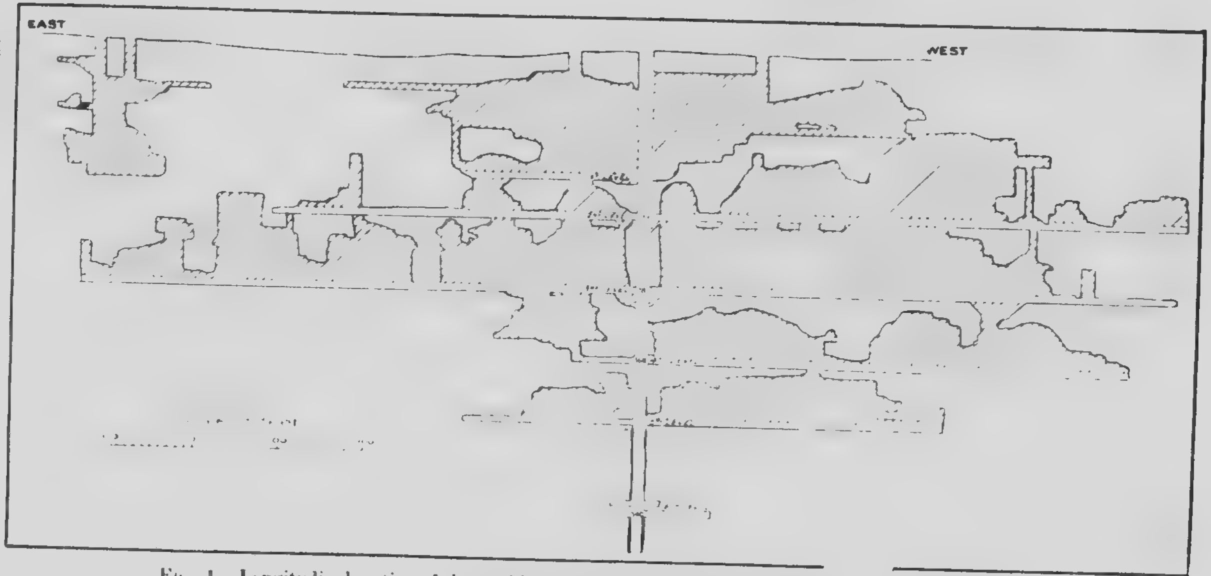


Fig. 1. Longitudinal section of the workings on the fissure vein at the Micm[illegible]ine, Leopsigate.

9869—p. 174

In 1904 the cyanide plant was still running and the old tailings beds were nearly exhausted. Forty-five men were employed by the Company and stoping was actively conducted. Preparations were also made for adding 5 stamps to the mill, thus making it a 15-stamp mill. In 1905, the shaft bottom was 545 feet deep and levels, No. 5 and No. 6, were driven at a depth of 443 feet and 540 feet respectively. The next year sixty men were employed, but only half as much ore was taken out as in 1905 and the yield was very much reduced, 890 ounces of gold and 169 ounces of silver being extracted from 2,543 tons of ore. The high cost of fuel was a serious problem and efforts were made, in 1906 and 1907, to make arrangements with the town of Liverpool whereby cheap electric power might be procured, but an agreement could not be arrived at regarding terms, and negotiations were broken off. During the early part of 1907 the shaft was deepened to 596 feet; later on mining was discontinued for a time, while the Company investigated the water-power possibilities of the vicinity. The mine was kept unwatered, however, to the 300 foot level, and work was resumed in December and continued until May, 1908, under the management of T. W. Moore. During this period 868 ounces of gold and 194 ounces of silver were extracted from 2,692 tons of ore. The ore was taken from the continuation of the old stopes, and no mining was done below the 300 foot level. In July some cross-cutting was done, but apart from that no other work was done after May 1, and in December the mine was closed.

Several other companies have carried on operations in this district. In 1901 the Scotia Mining and Development Company acquired the old German property, and under the management of C. N. Crowe extensive development work was done. This property is about a mile west of the Micmac mine and is thought to be on the same vein. The old German shaft was opened, but allowed to fill in January; it was pumped out again in May, but finally closed in July. Work was commenced on the Gilmour shaft, 780 feet west of the German shaft, on February 1, 1902, by the Home Gold and Copper Company under the management of C. N. Crowe. Some ore was taken out and tested at the Owen 5-stamp mill.

In 1903, a small yield was reported by Wade and Patton, but since then the only returns made from this district were from the Micmac mill. In 1905, P. H. Moore did some underground work at the Owen mine, but it was allowed to fill the following year. Other work has been done in this district but little record seems to have been kept of it. Veins in the northern part of the district have been opened at various times, and the most extensive operations seem to have been conducted by the Black Hawk Mining Company. Considerable work was done on the Gow lead and a 10-stamp mill was operated.

General Development.

The following tabulated statement shows the extent to which operations were conducted by the Micmac Gold Mining Company on the Leipsigate vein.[1]

Levels.	Depth from surface.	Northeast from shaft.		Southwest from shaft	
		1906.	1907.	1906.	1907.
No. 1.	154 feet.	195 feet.	195 feet.	....	....
" 2.	198 "	360 "	360 "	640 feet.	640 feet.
" 3.	285 "	664 "	664 "	634 "	634 "
" 4	368 "	84 "	84 "	559 "	574 "
" 5.	443 "	118 "	210 "	274 "	356 "
" 6.	540 "	30 "	Abandoned	25 "	Abandoned
" 6.	555 "	0 "	67 feet.	0 "	96 feet.
Shaft	596 "	Sinking 51 feet during 1907			

[1] Rep. Dep. Mines, N.S., 1907, p. 103.

No. 6 level was abandoned on account of bad rock encountered in [illegible] hanging-wall and a level was started 15 feet below this.

In 1908, mining operations were not carried on below the 300 foot [illegible] In July, a cross-cut from the 200 foot level, 380 feet east of the shaft, [illegible] driven south 119 feet, cutting a main lead at a distance of 99 feet, [illegible] raise was started on this new lead.

On the north branch of the vein at the east two shafts were sun[illegible] feet and 300 feet deep, while on the south branch the Crank shaft [illegible] sunk 50 feet.

On the middle section of the Leipsigate vein the property at the [illegible] end is known as the Gilmore property. Here a shaft was sunk 180 feet [illegible] at a depth of 100 feet a level was driven east 300 feet and west 50 [illegible] Adjoining this property to the east is the old German property on w[illegible] two shafts were sunk ab[illegible]ut 130 feet deep and 200 feet apart. A level d[illegible] at a depth of 110 feet connects the shafts and extends beyond each, ha[illegible] a total length of 500 feet.

The extent of the development in other parts of the district is g[illegible] in the chapter dealing with the character of the deposits and is indicated on the published plan.

There is an abundance of undeveloped water power within a [illegible] miles of the district, and the development of this and its applicatio[illegible] the mining industry may lead to a renewal of activity within this district

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton 2,000 lb.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	G[illegible]
1897	82	7	0	167	0	7	[illegible]
1898	1631	1	0	3421	0	9	[illegible]
1899	1161	8	0	3541	0	6	[illegible]
1901	423	12	5	819	0	10	[illegible]
1902	1135	2	14	2390	0	9	7
1903	2009	18	9	7861	0	5	[illegible]
1904	1680	14	0	6394	0	5	[illegible]
1905	2239	8	0	5503	0	8	[illegible]
1906	890	17	0	2543	0	7	[illegible]
1907	805	15	23	2584	0	6	[illegible]
1908	868	5	19	2692	0	6	[illegible]

Mint returns show that the gold obtained contained silver as follo[illegible]

	Oz.	Dwt.	G[illegible]
1903	281	12	[illegible]
1904	262	16	[illegible]
1905	402	9	[illegible]
1906	168	19	[illegible]

LOCHABER.

Lochaber is situated in the eastern part of Halifax county, 5 miles from Lochaber post-office and 11 miles north of East River Sheet Harbour, from which it can be reached by a good wagon road. The leads in this locality occur in a syncline near the top of the Goldenville formation. The strata dip south 60° to 78° and north 55°. Work in this place has been of an exploratory nature only. Most of the work was done on a vein with a dip north of 55° at the surface. The dip decreases to 48° with depth and the vein pinches out at the syncline. A shaft was sunk 62 feet on this. In 1887, J. H. Anderson opened several leads on the property of the Lochaber Company, and in 1888, Mr. Ashton made preparations for

opening the main lead and built a road to the mine from the end of the East River of Sheet Harbour road. The next year the Lochaber Gold Mining Company had a mill running, but little has been done here since except some desultory prospecting.

MALAGA.

Location.

Malaga gold district, also known as Molega, is situated on the eastern end of Queens county, between Malaga and Ponhook lakes. It lies 5 miles south of South Brookfield, a station on the Halifax and South-western railway.

Geology.

The Goldenville formation is exposed in an anticline with its axis following the southern part of the range of areas 551 to 600, block 5, and plunging to the east and west at low angles, the centre of the dome lying about area 537 on the east shore of Ponhook lake. On the north limb of this fold the strata dip north at angles increasing from 70° near the apex to 80° at a distance of 2,500 feet to the north, while on the south limb the dip increases from 45° to 55°. Three hills of drift running north and south have hindered surface exploration, but the veins no doubt continue beneath these.

Developments up to the present have revealed few faults. There are a few small faults on the Parker-Douglas property, but the most important one lies on the property of the Malaga Mining Company and runs northwest from the Nine-Boulder workings.

On the Parker-Douglas property a fissure 12 feet wide and filled with uncemented fragments of country rock runs at right angles to the strike of the strata.

Character of the Deposits.

The veins are of the interbedded class and lie in slate beds between strata of quartzite. Although a few veins have been opened on the south limb of the anticline, all the mining operations have been conducted on the north limb. The veins are in disconnected groups, and in their distribution do not seem to be so dependent on the main anticlinal structure as in other districts. Other unknown influences have been in operation and it is difficult to discern any general law in the distribution of veins or cross-shoots. Each group has its peculiarities with regard to ore distribution.

On the Malaga Mining Company's property the group of leads comprising the North, Chester Mill, and Crows Nest, worked respectively to depths of 100, 210, and 80 feet, has ore-shoots dipping east at low angles. These ore-shoots are formed by angulars from the foot-wall and are not well-defined.

On the same property the three Rabbit leads have ore-shoots dipping west. That on the Middle Rabbit is especially well-defined, dips west 30° to 35° and has been worked to a vertical depth of 292 feet, while that on the South Rabbit is not so regular and is formed by angulars from the south. This group of veins extends eastward past the hill of drift on to the property of the Boston Gold Mining Company. Here the Middle Rabbit was worked to a depth of 325 feet on an ore-shoot dipping east at an angle of 30°. The shoot was made by angulars from the foot-wall and was limited in depth by a big bull vein from the foot-wall. It was in this bull vein that a little scheelite was found.

The Nine-Boulder lead, 500 feet south of the Rabbit leads on the Malaga Mining Company's property, had an ore-shoot dipping west and worked to a depth of 110 feet, where it was cut off by a fault and could not be recovered. Much prospecting to the west, where there was rich drift, proved unsuccessful.

On the Parker-Douglas property and the northern part of the Boston Gold Mining Company's property a group of veins extends from 2,000 to 3,000 feet north of the anticline, and in the space of 1,000 feet 35 veins

have been cut. Ten of these have been worked to a depth of over 100 feet, the McClair being worked 150 feet, the Twin 160 feet, and the Big Ballou 260 feet. In several of these veins well defined ore-shoots dip west at low angles. These veins are concealed at the east and southwest by hills of drift and the presence of a swamp has prevented the exploration of some very promising ground right in the middle of the group. It is possible that a zone of veins extends from this group southwest beneath the hill of drift to the Rabbit leads.

On the Caledonia Mining Company's property two veins, thought to be the continuation of some on the Parker-Douglas property, have been worked, the Caledonia, possibly a continuation of the Twin, to a depth of 175 feet, and the Mill, lying 215 feet to the north, to a depth of 110 feet.

On the Minneapolis and Molega Company's property on the east plunge of the anticline work has not been very extensive, the 100 foot shaft on the Twin lead being the deepest. The ore-shoots appear to dip east with the plunge of the anticline. Some rich drift has been found on the Nelson and Fiske areas, but no veins of importance.

History.

This is one of the more recently developed districts and for a few years it took a prominent position among the producers of the Province. The average yield has been high, but it is believed that the statistics do not represent the actual production; for, as much of the gold was coarse, it is thought that a great deal found its way into the pockets of dishonest workmen and that quite a little even from the plates did not reach the owners. The district, however, saw a great deal of bad management, men with little or no mining experience were placed in charge of important works, business was conducted in an extravagant and unscrupulous manner, speculation was rampant, properties became involved in litigation, and as a consequence the district received a setback from which it never recovered.

Gold was discovered here in June, 1886, and the announcement of the discovery was followed by a rush of prospectors into the district, several auriferous veins were exposed, and before the end of the year mining operations were conducted on the properties of Wharton & [illegible] and McGuire and Smith. Prospecting and exploratory work continued during 1887, the settlement grew rapidly, and in 1888, a large number of buildings of all kinds had been erected and the population had increased to about 400 people. This year the Malaga Mining Company, Ltd., erected a 20-stamp mill on the shore of Ponhook lake and carried on active mining, under the superintendence of John McGuire, sending in very satisfactory returns. The Parker-Douglas Co., which had been organized in 1886, reopened its mines in the northern part of the district and put in a stamp mill and an air compressor. The Minneapolis and Molega Mining Company did a large amount of development work at the east end of the district and built a 20-stamp mill, but on account of the unsatisfactory nature of the yield operations were not long continued.

In 1889, the district was spoken of as the most important in the Province and nearly 4,000 ounces of gold was returned by the Parker-Douglas Company and the Malaga Mining Company, the latter producing over three-fourths of the total. This year there were four [illegible] in the district with a total of 65 stamps, all of which, however, were not in operation. The Minneapolis crusher was not running; the Malaga Mining Company carried on active mining; the Parker-Douglas Company increased the capacity of their mill and pushed operations; the Caledonia Company erected a very complete mill and did a large amount of development work in opening up several veins in the northeastern part of the district; and the Boston Gold Mining Company, incorporated this year, acquired areas east of the property of the Malaga Mining Company and opened up several important veins under the management of F. H. Ballou.

In 1890, the mill of the Boston Gold Mining Company was completed and put in operation. On the Malaga Mining Company's property op[illegible]

tions were carried on under the management of G. A. Wade, and the North and Rabbit leads were worked, while repairs were being made in the Chester Mill, Nugget, and Boulder leads. At the Caledonia mine Chas. McLeod, manager, thirty-six men were employed, prospecting by means of a diamond drill was carried on, and nearly 350 tons of ore crushed at the 10-stamp mill. Roderick McLeod, as manager, had forty men employed on the Parker-Douglas property, development work was carried on, and over 4,000 tons of quartz was crushed in the 20-stamp mill. All four companies made returns this year, but over half of the gold was produced by the Malaga Mining Company.

In 1891, returns were made by the Parker-Douglas Company, the Malaga Mining Company, and the Boston Gold Mining Company. Over 4,800 ounces of gold was reported and nearly half of this was produced by the Boston Gold Mining Company, under the management of F. K. Ballou. The Caledonia mine was idle, the mill having been destroyed by fire, and during the year the Parker-Douglas mine was also closed. G. A. Wade was still conducting operations at the Malaga mine and Charles McLeod had eight men employed on the Nine-Boulder lead.

The Boston Gold Mining Company and the Malaga Mining Company made good returns in 1892; the latter Company having reported in round numbers 9,900 ounces of gold from 7,500 tons of ore from 1888 to 1892 inclusive. At the time of the inspector's visit in 1893, the Boston Gold Mining Company was the only one working, and F. K. Ballou had twenty-five men employed. In addition to this a little prospecting was done on the Parker-Douglas property.

During 1894-6, inclusive, the most important returns were those made by the McKay mill. In 1895, some little work was done on the property of the Malaga Mining Company, and the Boston Gold Mining Company, under the management of Mr. Turnbull, did considerable development work. The Old Minneapolis mine was pumped out and extended, under the management of Mr. Dixon, and, although it was stated that the quantity of ore and its appearance justified the expectation of a resumption of operations, little results seem to have followed, as the mine is not mentioned in the report for 1896.

During 1896 D. S. Turnbull and Mr. Doull did some work on the Twin lead on the Parker-Douglas property, and A. J. Cox had twelve men employed on the McClair lead for the Old Provincial Mining Company. The year 1897 saw R. R. McLeod working with twenty-nine men on a new lead called the McLeod lead on the Parker-Douglas property. Good returns were made this and the following year by Mr. McLeod. In 1897, Logan Ball had sixteen men employed on the Twin lead and Sydney Aldred had seven men working on a 2½ inch lead north of the Twin lead. All this work was under the superintendence of R. R. McLeod. Subsequently to 1898 about the only returns made were those made by tributers, and no returns were made between 1902 and 1908. In 1904 the properties of the Parker-Douglas Company, the Boston Gold Mining Company, and the Caledonia Mining Company were amalgamated under the title the Markland Mining Company, capitalized at $1,000,000, and shares were offered to the public.

In 1908 work was resumed under the management of W. J. Prisk and in July the west shaft on the centre or main Rabbit lead was reopened. This is one that had been sunk many years previously by John McGuire. Several prospect pits were sunk also on the Hard lead.

During 1909 twenty-eight men were employed by the Ponhook Mining Company, W. J. Prisk, manager. The shaft on the Rabbit lead was continued to a depth of 292 feet. At a depth of 274 feet the vein was lost by a fault 'pitching south 36 degrees and west 24 degrees.' Levels were driven at a depth of 242 feet and a cross-cut driven south 56 feet cutting the South Rabbit lead 18 feet south of the main Rabbit lead and the Slate lead 50 feet south of the main Rabbit lead. Some drifting has been done on all, and stoping on the 110 foot level east of the shaft, and on the 242 foot level west of the shaft as well as a small amount on the Slate lead. Crushing was done in the old Malaga Mining Company's mill.

General Development.

The plan published in 1907 shows the location and depths of the s[illegible] as well as the bore-holes on the Parker-Douglas and Caledonia proper[illegible] On the former a bore-hole was run 375 feet south from the South lea[illegible] a depth of 100 feet, and on the latter there is a length of 900 feet at [illegible] same depth. Application having been made to the Department of M[illegible] N.S., for assistance in sinking a vertical shaft, E. R. Faribault wa[illegible] quested to prepare a report. In this he recommends the sinking [illegible] vertical shaft north of the anticline and in the vicinity of Ponhook [illegible] on areas owned by the Malaga Mining Company. Before determining [illegible] position of the shaft he suggests, however, that much surface prosp[illegible] be done.

It seems also that future operations might be directed to the testi[illegible] the old workings, as it is probable that many ore-sh[illegible]ts were not w[illegible] out.

There are good water powers within reasonable distance, one on the stream flowing from Malaga lake into Ponhook lake and another at G[illegible] field at the outlet of Ponhook lake.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	G[illegible]
1889	3076	3	13	4388	0	18	[illegible]
1890	3883	12	12	6633	0	11	[illegible]
1891	4664	13	17	4826	0	19	[illegible]
1892	2656	5	14	2720	0	19	[illegible]
1894	1060	11	0	1688	0	12	[illegible]
1898	2040	0	0	1200	1	11	[illegible]
1901	226	17	0	173	1	6	[illegible]
1909	615	14	5	1021	0	12	[illegible]

McKAY SETTLEMENT.

This gold district, also spoken of as Ashdale, and Meander R[illegible] Upper Newport, is situated in Hants county 1 mile southwest of [illegible] Newport and about 5 miles by road east from Brooklyn station [illegible] Midland division of the Dominion Atlantic railway.

[1] The gold-bearing series here forms an anticline, the axis of [illegible] runs N. 60° E. (magnetic) and plunges to the northeast. The fo[illegible] the strata immediately north of the axis dipping at an angle of [illegible] those at the south dipping at angles increasing from 10° to 35°. At t[illegible] of McKay settlement the Goldenville formation is exposed, while th[illegible] fax formation extends eastward. The latter formation, in which t[illegible] ferous veins are found, consists of bluish-black, pyritous slate w[illegible] ional beds of black fine-grained quartzite. To the north of this a[illegible] and within half a mile of it the gold-bearing series is overlain by [illegible] boniferous limestones.

The rocks are well exposed in the streams crossing this anticline, and along Little Meander river several interbedded quartz veins hav[illegible] prospected. The veins show rolls and carry sulphides. There a[illegible] belts of slate with numerous small veins which might furnish large b[illegible] of low grade ore. The most of these veins a[illegible] found below the iron bridge over the Little Meander. Half a mile south of the main road is [illegible] vein, 4 inches wide, carrying much mispickel. It strikes 180° (m[illegible]), dips east 85°, and had a 50 f[illegible] shaft sunk on it by John Withrow

[1]Ann. Rep. Geol. Sur., Can., XII, 181 A.

[1] A discovery was reported in 1868 but work has been little other than of an exploratory nature. In the flat intervale beginning 1,500 feet below the iron bridge, the alluvium has been washed for gold, so also has that on the Meander river below its junction with the little Meander.

MILLER LAKE

Miller Lake gold district lies in the western part of Guysborough county, 5 miles by rough road from Ecum Secum Bridge, which has a daily stage and mail from Sherbrooke.

The Goldenville formation is exposed here on an anticline that was indicated in the map of this part of the Province before gold was discovered at this point. On the north limb the strata dip north at an angle increasing rapidly to 45° and 50°, and on the south limb the dip is to the south at angles varying from 50° to 75°. The fold plunges to the east and west forming a dome.

The veins follow the stratification planes and lie close to the anticlinal axis on each limb. [2]In 1903 a great number of veins had been exposed and some had been prospected for short distances by open-cuts or shallow pits. They were found to vary from a few inches up to 12 inches in thickness and a few auriferous rolls were found attaining a thickness of 18 inches and dipping east with the plunge of the anticline. Of the veins then discovered, the Naugler and Lonecloud leads on the north limb and Mill lead on the south limb were the most important and a little sinking had been done on these.

According to a prospectus issued by The Miller Lake Gold Mining Co., Ltd., in 1905, a shaft had been sunk 105 feet cutting a number of auriferous veins and a cross-cut had been driven 210 feet cutting the veins at right angles. In this cross-cut many auriferous veins were cut varying in thickness up to 12 inches. The north lode on this property, that is the Lonecloud lode, had been traced 3,600 feet and was found to be auriferous for that length. As an inducement for the investment of capital in this district the Company calls attention to the Liscomb falls a few miles away, from which can be developed, it is claimed, 2,000 horse-power.

Rich float has been found at different points along the anticline. So far as revealed by present development the zone of enrichment appears to run parallel with and close to the anticline.

In 1902, the Liscomb Falls Gold Mining Company did some work on the Mill lead and erected a 5-stamp mill, formerly owned by Robt. Brownell. Some prospecting was done in 1903 by E. H. Oland, Capt. Smith, and Chas. Allen, and in 1905 and 1906 work was carried on by the Miller Lake Gold Mining Company, Ltd., and crushing was done at a 10-stamp mill built in 1905.

MILL VILLAGE.

Mill Village district lies in the southeastern part of Queens county, a mile west of Port Medway river, and 3 miles north of Medway station, on the Halifax and Southwestern railway.

The rocks consist of whin and interstratified beds of slate belonging to the Goldenville formation, and dip south. The great thickness of the drift makes prospecting difficult, but [3]a number of interbedded veins have been exposed, and a few belts of closely interstratified slate and quartz. The main lead of the Gold Eagle Mining Company is an 8 inch vein in the middle of a 3½ foot slate bed with quartzite walls; this strikes 240° (magnetic) and dips south 57°. Some distance north of this an 8 inch vein in a 4 foot belt of slate with whin walls has been worked.

The discovery of rich drift encouraged prospecting in this district during the eighties and nineties. Prospecting was very expensive on

[1] Report of Chief Commissioners of Mines, Nova Scotia, 1868, p. 8.
[2] Faribault, Geol. Sur., Can., XV, 180 AA.
[3] Report of the Dept. of Mines, Nova Scotia, 1899.

account of the thickness of the drift. Among those to engage in exploratory work were B. H. Porter and G. W. Goddard, who ran [illegible] feet of trenches and tunnels about 1888; in the years 1889-90, [illegible] Cashon and W. H. Prest searched for the 16 inch lead from which [illegible] ferous quartz boulders had been discovered; about 1891, Chas. and W. Hall made a strong effort to find it but became discouraged by the [illegible] feet of drift and trouble with water; and in 1896 Joseph Zink also prospected here. The district remained quiet until 1898, when Jason Mu[illegible] discovered the vein, afterwards mined by the Gold Eagle Mining Company. In 1899 other veins were [illegible] this year American [illegible] became interested and the Gold [illegible] Mining Company was chartered and capitalized at a very high [illegible] 1900, this Company [illegible] a 10-stamp mill and carrie[illegible] development. In 1901 returns for this district were [illegible] from 1,057 tons. The [illegible] shaft is 190 feet deep. At a [illegible] feet levels were driven [illegible] 160 feet and west 300 feet, cro[illegible] run 60 feet north and 60 [illegible] south, and diamond drilling was [illegible] 40 feet farther north at the end of the north cross-cut. The [illegible] lead was a [illegible] in the north cross-cut, although on the surface a [illegible] inch lead was exposed 65 feet north of the main [illegible] another 5 inch lead 95 [illegible] north. On the 8 inch vein [illegible] shaft [illegible] 60 feet [illegible] 10 tons of quartz was crushed.

[illegible]

[illegible]ation.

Montague gold district lies in Halifax [illegible] about 5 miles [illegible] of Dartmouth across the harbour from Halifax, from which it is a[illegible] by wagon road.

Geology.

[2] The Goldenville formation here forms a long and narrow [illegible] dome with an axis running N. 78° E. The plunge to the east is 5° on [illegible] 834 and 835 and 8° on area 781 farther east, and the plunge to the [illegible] is about 5° on the north part of area 951, 15° on area 931, and 21° on a[illegible]. The strata dip at a low angle to the north and south near the ant[illegible] axis, but the dip gradually increases until it is vertical 1,000 feet [illegible] the axis, and 70° at a distance of 1,250 feet north of it. The axial [illegible] therefore, dips north about 80°.

Faults are neither numerous nor large. One radiates southward [illegible] near the centre of the dome and gives a horizontal displacement [illegible] at the Lawson lead, while a few other parallel faults met with in th[illegible]ings of the Skerry, Rose, and other leads have a strike almost [illegible] with that of the strata and dip south at a low angle. These latt[illegible] of the nature of thrusts.

Character of the Deposits.

The veins follow the stratification planes and those that hav[illegible] remunerative lie in a zone about 600 feet wide, the northern [illegible] which is about 500 feet south of the anticlinal axis on that par[illegible] south limb where the dip varies from 80° to 90°. Among the [illegible]portant of these may be mentioned the Belt, De Wolfe or Annan[illegible] Rose, and Skerry leads. In many of the leads pay-shoots dip to [illegible] at a low angle, while in others, and especially in those in the sout[illegible] part of the district, the pay-shoots occur at the intersection [illegible] lars with the main leads.

A few veins have been prospected on the western continuat[illegible] anticline where it crosses the road to Waverley and on the [illegible] tension on the east side of Lake Major.

Rich drift has been found on the Preston road, 2 miles [illegible] district, and much time has been spent in trying to find its source.

[1] Report of the Department of Mines, 1900.
[2] Faribault. Geol. Sur., Can., XI, 152 A.

History.

The discovery in the early sixties, of a boulder weighing less than 100 pounds and yielding in the mortar gold to the value of $1,600, led to careful prospecting in this district. Numerous other rich boulders were found and the lead known as[1] the Lawson lead was finally discovered by Messrs. A. McQuarrie, A. Robinson, J. O'Connor, and B. Clarke. The district was proclaimed such in the early part of 1863 and mining operations commenced, but were not carried on with that vigour that the high average yield of the quartz would seem to justify. The production for 1864 and 1865 was higher but it declined again in 1866.

In 1865 a crusher was erected, all the ore up to this year having been milled at Waverley. Only two mines were worked in 1866; these were on the same lode, the Belt, and were operated by the Albion and Union companies. Both companies mined by open-cut, the former making a cut of [illegible] long with an average depth of 80 feet, and the latter, 381 feet long with an average depth of 15 feet. The Union Company was the only one working in 1867, and shafts were sunk on the old lode and a part of the ground stoped out. This Company also opened the South or Werner lode during this year but it received little attention the next year.

In 1868 the only operations of any importance were those carried on by the Montague Company on the lode worked by the underhand stoping throughout a length of 366 feet, and eight different shafts were used. This lode, the Belt lode, had been worked continuously since its discovery in 1863 and operations were continued in 1869 by R. G. Leckie and Company, at the Montague mine, once known as the Union mine. In the early part of the year the Belt and Werner or St. Patrick leads were worked, but operations were later suspended on these because of insufficient machinery and work was directed to two newly discovered lodes, the Lydia and the Sarah, probably those indicated on the plan as the Lydiard and York. The former was opened a length of 320 feet and the latter 140 feet. Both these lodes were cut by cross leads some of which proved quite rich. This Company found their light 8-stamp mill unequal to the task of crushing their ore and by the close of the year had a 15-stamp mill nearly completed.

Some prospecting was done in 1869 by Messrs. Temple and Salter, and an association of Welsh miners opened the Bendigo mine but later ceased work and sold out.

One of the most important events of the year was the reopening of the works on the Belt lode at the old Albion mine, formerly called the McQuarry mine. This was reopened by Messrs. W. and E. Lawson, who carried on continuous active operations until some time in 1874 and took out 10,000 ounces of gold, the yield in 1871 being as high as 2,272 ounces from 68 tons, and in 1870, 2,582 ounces from 447 tons and 7,792 days labour. In 1873 an efficient 10-stamp mill was erected and the main shaft carried to a depth of 300 feet. Work was carried on at this mine in a most systematic manner and a plan of the workings was kept, on which was recorded the yield of the quartz in the different parts of the mine. The rich portion of the lead dipped westward, and the quartz in the eastern part of the mine diminished in thickness and value with depth. The western slopes also became impoverished with depth and the yield became so small as to make it no longer profitable to keep the mine opened. The Messrs. Lawson ceased work in 1874, and the mine was let to tributers, who, however, reported very little gold, the returns being so low as 50 ounces in 1877.

The Montague mine was transferred from Messrs. Leckie & Co. to Messrs. Taylor and Weir, the new mill was started in June, 1870, and active mining was carried on during the year. The principal work was done on the following three leads: the Belt lode, where the main shaft was carried to a depth of 160 feet and the east and west shafts 150 feet; on the St. Patrick, which was mined to a depth of 70 feet; and on a rich cross lead, which was worked from a shaft on the Sarah lode. In 1871 this Company reported 724 ounces from 309 tons, the most of which was taken from the St. Patrick lode, operations on the Belt lode having

[1] Industrial Advocate, Mar. 1897, p. 12

been entirely suspended. The next year the Company ceased work the St. Patrick lead was worked a little by tributers, who were to quit through the crushing of their hanging-wall.

In 1871, a mine was opened by Messrs Brown and Barker on trib on the property of the Montreal Exploration Company. In 1872 Wolfe & Company sank three shafts on the Fissure or North opened the South lead by two shafts, and erected an 8-stamp mill. two leads are marked on the plan DeWolfe and Twin respectively. 1874 this property was mined by tributers on area 1166, known as digo. Symond's property was also let to tributers, who worked the lead on area 1461. Work at Bendigo and on the cross lead on area continued during 1875. In 1876 work on area 1461 ceased, but resumed later in the year by another set of tributers. Some gold obtained by tributers on the outcrop of the Belt lode on the property. The next year some prospecting was done and some on the Belt lead on the Lawson property, on the St. Patrick lea on the cross lead, and the adjoining Sarah lead. Little gold wa tained, however, and very little in 1879, during which year some ing was done at Bendigo on the DeWolfe lead.

After several years of comparative stagnation this district new life in 1879. This was due to the discovery of a rich lead the Rose lead from the colour of the quartz boulders derived fr These rich boulders had been known for some time and frequent were made to discover their source. Finally Geo. W. Stuart be interested in the search, and after a careful inspection of the direct of glaciation and systematic work he succeeded in exposing the lead on December 7, 1878. The property was sold to some American active operations were carried on with large yields until the autu 1880, when a flat fault was met that passed so much water as to flood mine. New pumping machinery was procured and the mine pum out early in 1881. Operations were started on what was said to b eastward extension late in 1880 and carried on in 1881. This, how seems not to have yielded profits, for the Rose Gold Mining Com ceased working in 1882.

The discovery of the Rose lead stimulated operations in other p of the district. On the Symond's property a lead, probably the Sh was opened to the west of the mill, work continued during 1880, another opening was made about 2,000 feet west of the mill where lode proved rich. Work ceased for a while in 1881 during the repa of the mill, but was again resumed and continued during 1882, the property was known as the Symonds and Kaye property. M Symonds did a little work here in 1883, and others prospected the ern part of the property.

In 1879, a few lots of quartz were taken from the Temple prop and in 1880 it was prospected by Mr. Stuart, who sank a shaft on eastern extension of the Rose lead. Mr. Sutherland did some w 1879, and in 1880 he worked some areas lying immediately west of Temple area, besides opening several promising lodes on area 135 on an area adjoining the Free claim. In 1881, Mr. Sutherland cont working his properties and prospecting was carried on by Messrs Donald, Stutter, and Foster. During the autumn a concentrating was erected a few yards east of the Symonds property by T. B. Ha dry process of concentrating was to be applied to the tailings of th district. The plant was destroyed by fire in 1882, but rebuilt the fol lowing year, and work was carried on a short time during the summer 1884.

In the autumn of 1883 the Bluenose Gold Mining Company started work on the DeWolfe areas, and the next year the DeWolfe lead was worked and three shafts were sunk on the Twin lead about 60 feet to the south containing two veins 10 inches and 5 inches thick respectively. Work was continued on the DeWolfe and Twin leads by the New Albion Gold Min ing Company in 1885, and stopes were carried along the former lead for a distance of 700 feet, and along the latter, 500 feet. A pay str was struck yielding 1,369 ounces from 337 tons. Although 4,001 ounces were extracted this year from 2,800 tons, work at this mine ceased the following spring.

Surface plant of the New Albion gold mine, Montague

In 1884, Mr. Gladwin did some work on the British American areas, adjoining the DeWolfe property on the east, and in 1885 Mr. Oakes and others did some prospecting to the south. In 1886, Mr. Hale reopened the main lead on the Symonds property, but work was not continued long. For several years little was done in this district except a small amount of tributing, although W. S. Skerry and Company reported 498 ounces in 1888 from the Skerry lode on the Symonds and Kaye property.

The year 1889, however, saw a marked revival in the mining industry of the district. Charles Annand, into whose hands the New Albion or DeWolfe property had passed, reopened the mines and carried on vigorous operations. The Rose mine was reopened and some very rich ore found; the Montreal property received some attention from tributers and good returns were made by tributers on the Symonds-Kaye areas. Returns were made from the Annand, Rose, and Symonds-Kaye properties in 1890 and the production of the first for this year was nearly double that of the preceding year. In 1891 returns were made from the Annand and the Symonds-Kaye properties, but there was a considerable decrease. In August this year A. P. McQuarrie was manager at the Annand mine and had twenty-eight men employed. Preparations were being made to erect a new mill. Wm. Skerry had fourteen men employed on the Symonds-Kaye property; T. M. Baker was working the Iron lead and Mr. Pratt the Sutherland mine.

In 1892, a London syndicate known as the Nova Scotia Mines Syndicate, Ltd., acquired through Alfred Woodhouse the Annand, Lawson, Rose, and Montreal properties and carried on operations for a year or two, under the management of Lucius J. Boyd for a short time and then of W. R. Thomas. In 1894 the Nova Scotia Gold Mines, Ltd., took over the property, which continued under the management of W. R. Thomas. The mine was idle at the time of the inspector's visit in 1895, sold to A. P. McQuarrie on December 16 of the same year, and later passed into the hands of the Golden Group Mining Company, incorporated 1896, of which the directors were Messrs. Hayward, Andrews, and Bell.

Eighteen men were employed by the Salisbury Gold Mining Company in 1893 under the management of P. T. Pride; a 5-stamp mill was completed and ore was taken from the Maynard and Skerry leads. In December, Geo. H. Nissen took charge and worked the Skerry lead. The same year H. Lawson was manager at the Symonds-Kaye mine, where a 10-stamp mill brought from Margaret bay had been erected. This property had been purchased the preceding year by Lucius Boyd representing the Symonds-Kaye Syndicate, and A. P. McQuarrie had been made manager. On December 23, 1893, four men were drowned in the mine by a shot producing an opening between the new workings and some old workings which were filled with water, thus flooding the new level. The disaster was the result of a lack of proper plans of underground workings. Some crushing was done on this property in 1894, but it seems to have been idle in 1895. [1]In 1894 the Nissen mill on the Salisbury property was removed and foundations for another mill were laid.

The Golden Group Mining Company was working on the Belt or Lawson lead in 1897 under the management of A. A. Hayward, and the main shaft had since September, 1896, been sunk 110 feet, so that its depth was then 310 feet. Work was continued here until the middle of 1898 and then attention was directed to the old Annand mine. This was opened after some time had been spent in putting in new machinery and refitting the mill, which then contained 15 stamps. Crushing from the Annand property began in October, but as the yield was unsatisfactory the work was discontinued.

Work on the Oland or Symonds-Kaye property resulted in some rich ore being taken from the Skerry lead east of the old mill in 1897, and work continued in a desultory fashion the following year, but with much less favourable results. During 1897 tributers did some work on the Skerry and Nugget leads as well as on the Salisbury property, and on this last property work was continued during the following year.

The Golden Group Mining Company had tributers at work on the Skerry lead under the management of D. McAskill in 1899 and 1900, and others worked different properties during these years on tribute. Some

[1] Can. Min. Review, Sept. 1894.

little tribute work has been done in this district nearly every year since, but the greatest production for 1899 to 1902 inclusive was reported by S. Y. Bauld, who had come into possession of the Oland property. Very little was produced in this district in 1907 and only about 2 ounces in 1908.

General Development.

Little information on this point is available, but the published plan gives the location of the different shafts sunk, together with their depths. In a great many cases the most of the ground between the shafts has been worked out, so the plan gives a pretty good idea of the extent to which operations were carried on in the past.

The zone of special enrichment appears to run nearly parallel with the anticlinal axis. Speaking of the Lawson, Annand, Twin, and Rose leads, Faribault says: 'Although there is reason to believe that the limit of the pay-zone has not been reached on the above-mentioned leads, at the depths to which they have been worked, it is probable that in some of them the limit of the high grade ore is near at hand. For the zone of rich streaks appears to be narrow, and as it is parallel with the axis-plane, it dips to the north at an angle of 80°, whereas the dip of the veins is to the south, angle about 80°, so that the two planes would give a diverging angle of 20°, and so limiting the length of the pay-streaks on individual veins. Thus, to keep in the pay zone it becomes necessary to cross-cut north when the limit of the pay-streaks has been reached, and new veins will in this way be developed which might be barren or wanting on the surface.' Three leads from which it would be especially advisable to cross-cut are the Annand, Belt, and Rose.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1863	366	14	16	140	2	16	2
1864	1,052	19	14	545	1	18	15
1865	902	12	13	615	1	9	8
1866	496	15	10	382	1	6	0
1867	436	15	16	244	1	15	11
1868	584	12	22	353	1	13	10
1869	805	13	14	572	1	8	3
1870	3,831	9	5	916	4	3	14
1871	3,152	8	15	848	3	14	8
1872	1,793	10	6	683	2	12	17
1873	1,440	3	9	679	2	2	9
1874	655	0	22	496	1	6	10
1875	287	18	17	72	3	19	23
1876	149	1	17	81	1	16	19
1877	50	1	9	55	0	18	5
1878	158	6	12	192	0	16	12
1879	1,527	10	20	485	3	3	0
1880	4,270	8	17	1,221	3	9	22
1891	900	6	16	1,165	0	15	10
1882	684	9	22	586	1	3	8
1883	74	4	5	76	0	19	12
1884	736	12	23	539	1	7	8
1885	4,001	6	2	2,809	1	8	4
1886	87	14	0	77	1	2	18
1889	1,901	10	6	953	1	19	21
1890	2,263	1	0	1,411	1	12	0
1891	1,361	1	0	863	1	11	10
1892	2,201	10	0	1,716	1	5	15
1893	511	11	8	740	0	13	19
1897	1.177	1	7	956	1	0	6
1898	199	8	10	1,992	0	4	8
1899	976	14	18	1,816	0	10	18
1900	481	3	7	636	0	15	3
1901	437	15	2	595	0	14	17
1908	1	15	0	(Mortared)			
1909	1	15	15	(Mortared)			

9869 p. 186

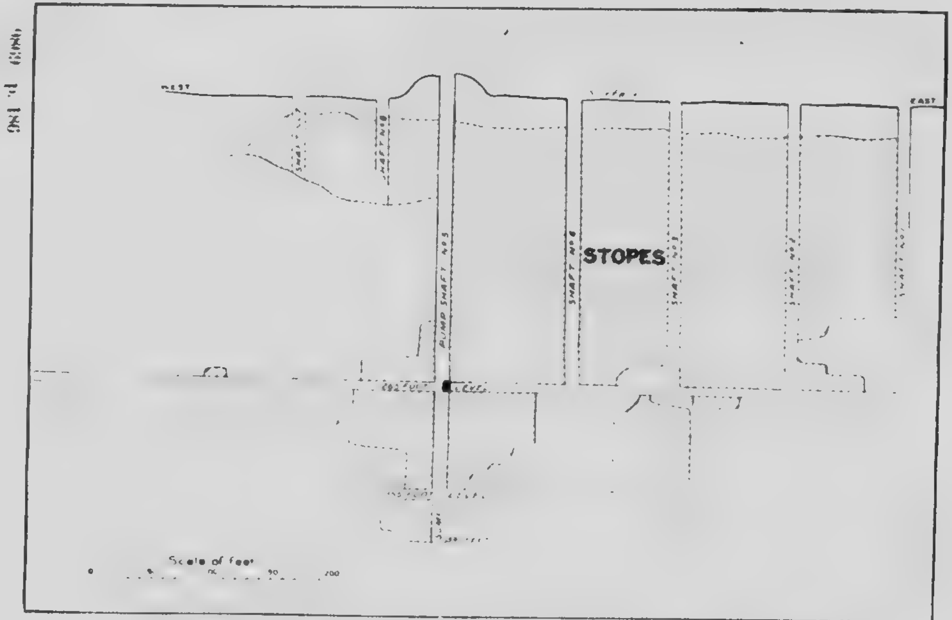


FIG. 5. Longitudinal section on the principal workings of the Annand lead, Montague.

MOOSE HEAD.

Moose Head or Shears Point lies in the eastern end of Halifax county, 2 miles south of Moser river. It lies on the Tangier-Harrigan Cove anticline between Harrigan Cove and Ecum-Secum. The deposit that has received the most attention is a 20 inch quartz vein lying in a 4 foot slate bed dipping south 45°. A little work was done here prior to 1873, and again in 1874, when 12 tons of ore was crushed. In 1880 Campbell and Smith were engaged in erecting a mill and in opening some lodes, but little was done the following year. In 1899 a Company began in April to erect a modern mill under the management of Edward Brownell, but in June a fire destroyed the nearly completed structure together with boarding-house and barn. The Company began to rebuild at once, but early in July of the following year the mill and entire surface plant were again destroyed by fire. A shaft had been sunk 150 feet on the lead and it is said that cross-cuts had also been driven north and south 100 feet and had cut some good leads.

MOOSELAND.

Location.

Mooseland gold district is situated in the eastern part of Halifax county, 12 miles northwest of Tangier gold district, from which it is accessible by a wagon road. It can also be reached by wagon road from Shubenacadie.

Geology.

The Goldenville formation is here exposed in a closely folded anticline. The anticline plunges to the east and west forming an elongated dome, the plunge to the east being 10° and to the west 5°. The dip of the strata increases very rapidly and at a distance of 50 to 100 feet from the axis reaches 75° to 80°. The axis does not form a straight line, but curves with its convex face to the south, and from the centre of the dome runs approximately east (magnetic), and in the opposite direction N. 80° W. (magnetic).

[1] 'Several lines of faulting have caused important displacements at the east end of the district. The westernmost of these runs S. 35° E. (magnetic) along the edge of a flat on the west side of the Tangier river and gives a horizontal displacement of 560 feet to the north on the east side, the anticline situated 48 feet north of the Irving lead being the same as that immediately south of the Bismarck lead.

'On the east side of the Tangier river, another main fault, running parallel with the first, passes through the west Otter pond and follows its brook to the south, while northward it follows the river along Grassy lake. The Bismarck lead anticline is shoved 1,500 feet to the north on the east side of this fault, to a ridge 150 feet north of the west Otter pond, and 50 or 100 feet north of the Brown lead opened here. The pitch of the anticline, which is to the east on the Bismarck lead, is changed to the west on the east side of the fault where the veins will curve westward around the fold. Small faults exist no doubt between this fault and the Bismarck lead, and one was located at the east end of the workings on this lead, but a great thickness of drift east of the river prevents the determination of others.'

A large granite mass lies immediately to the southwest of the district.

Character of the Deposits.

The veins are of the interstratified type and among the most important may be mentioned the Bismarck, Irving, Little North, Specimen, Cummings, and Furnace, the last named being the first vein worked in the Province. Nearly all the operations have been limited to the south limb of the anticline, and as the axial plane is vertical this deposition of the ore on the one side only may be due to the difference in structure dependent on the curving of the anticlinal axis. The zone of enrichment lies close to the axis, as is generally the case in close folds.

[1] Faribault. Geol. Sur., Can., X, 114 A.

A large belt of four veins, giving 15 feet of quartz in the space 35 feet, has been exposed for 1,850 feet along the apex of the antic north of the Irving lead. At the south end of Moose lake a few v have been traced to the granite. They show no disturbance from th intrusion.

In the veins on the apex of the fold several geodes containing quart crystals were found, and in the Irving lead crystals of rutile were fou in the quartz.

History.

Mooseland has to its credit the first discovery of auriferous quar leading to the beginning of the gold mining industry in Nova Sco [1]The first find was made by Captain L'Estrange in September, 1858, b it led to nothing further. In May, 1860, John Pulsiver, accompanied one of Captain L'Estrange's Indian guides, happened upon the sa spot and discovered auriferous boulders; the discovery was made kno and in that same year mining operations were started by John Morr on the Furnace lode. In April, the next year, the district was claimed and surveyed.

[2]Among the early workers of this district were [3]W. H. Newm Henry Hesselein, and Mr. Ellershausen. They began operations in 18 and continued intermittent work for several years. The first stamp m consisting of four wooden stamps, was erected in 1862 by Ellershau but this was replaced by a better mill erected the next year by N man. [4]C. E. Willis states that the first mill of the Province was ere at Mooseland, afterwards taken to Tangier, then to Chezzetcook. T first apparatus for extracting gold at Mooseland is described by J. H Townsend as [5]"a large flat rock with a slight incline to the north, th direction I believe is important, on account of the electrical affin In the centre is a hole, which extends through a smaller stone, grinder; in the underside of the grinder is a concave opening f insertion of the ore, and in the mill itself, that is the larger rock cut a groove for carrying off the slimes."

For a few years after discovery little progress was made in district owing to the difficulty of access, but by 1866 a passable road w completed and mining recommenced with vigour. During 1866-8, M Adams & Co., otherwise known as the Beneficiary Gold Mining Comp carried on work on the Furnace, Cumminger, and Specimen leads ing several shafts and doing considerable stoping. In 1868 And Barton and David Estey opened several veins south of Sluice lake, b they were never developed and probably are of little value.

In 1869, the Adams Company sold out their mining interests Fletcher, Crossland, & Co., who became known as the Humber Mining Company. During this year the Irving belt was discovered a this was worked by the Humber Company until 1871, the ore crushed at their 8-stamp mill. In 1870, a 450 foot drainage tunnel driven on the Irving belt from the water level of the river, and from a 100 foot cross-cut was run to the south, which intersected the N Specimen, and Cummings leads. During this year work was done o Furnace, North, Specimen, and Irving leads and continued on the lead during the following year.

For several years after this, work in this district was carried by tributers, chief among whom was Mr. J. Irving. During 1872, worked the Irving and Furnace leads and continued to employ men for several years, sinking and stoping. In 1876 and 1877 a work was done on the Irving and Cumminger leads, and in 1879 on the Irving. In 1881, Mr. Crossland ran a cross-cut north from the Irving lode to intersect some parallel veins. In the eighties, Mr. Irving and others did some tributing on the property of the Humber Company, principally on the Irving, Furnace, and Edwards leads.

[1] Heatherington. Guide to the Gold Fields of Nova Scotia, p. 31.
[2] Industrial Advocate, June, 1899, p. 16.
[3] Ind. Adv., June, 1899, p. 16.
[4] Trans. Min. Soc., Nova Scotia, I, Part II, p. 6.
[5] The 'Critic,' Nov. 11, 1887.

In 1884, a number of auriferous boulders were found on the west side of the river in that part of the district known as North Mooseland, and as a result of the interest thus aroused a great deal of prospecting was carried on for a few years and several leads were discovered. In 1890, Mr. Stemshorn discovered the Bismarck lead, and the same year the Mooseland Gold Mining Company was organized to work it. The next year a 5-stamp mill was erected and operations were carried on for a few years under the management of H. G. Stemshorn. The production was: 1892, 373 ounces from 893 tons of ore; 1893, 471 ounces from 1,323 tons; 1894, 431 ounces from 1,355 tons. In 1893 the district lost its chief pioneer by the death of J. Irving. In 1895 there was a new 10-stamp mill at work and 25 men were employed.

In 1896, Wm. Yeadon did some work on the Cummings belt, having acquired the Musgrave areas, so-called from the name of an Englishman who had undertaken to do a little mining here in 1882. In 1898 this property had been purchased by the Arlington Gold Mining Company—J. H. Greene, manager—and an angular crossing the workings on the Lake lead was worked. There was an old 4-stamp mill on the property, run by an upright engine; the destruction of this mill by fire put an end to the work in December of this year. Operations were resumed by this Company under the management of J. A. Reynolds in December, 1899, and preparations were made for erecting a 5-stamp mill. In 1901 the mill was completed and the shaft on the Cummings belt was continued to a depth of 100 feet. In 1903 work was started again on the shaft, the intention being to sink it to a depth of 150 feet. Little or nothing, however, has been accomplished in this district in recent years. The history would be incomplete without the mention of John Murphy, who is well known for the great amount of prospecting he did in this district.

General Development.

There is little other information available on this point besides that contained on the published plan. Since its publication in 1899 the 50 foot shaft on the Cummings lead was carried to a depth of 160 feet and a cross-cut was driven some distance north.

The large belt of veins on the apex of the anticline might be worth testing on their eastern pitch and at greater depths on the south leg. They are probably underlain by other saddle veins that should be taken into consideration in the question of deep mining. The anticline [illegible] Otter pond also seems favourable ground for prospecting.

The production of this district is included in that of Tangier.

MOOSE RIVER.

Location.

Moose River gold district lies in Halifax county, about 34 miles to the southeast of Shubenacadie, a station on the Intercolonial railway, from which it is accessible by a good wagon road. [illegible] reached from Tangier on the coast [illegible] southeast, by means of [illegible] Mooseland road running northwest through Mooseland and [illegible] east of Moose river.

Geology.

The district is situated in the centre of a wide zone of the interbedded slates and quartzites of the Goldenville formation. In this locality is exposed a greater thickness of this formation than is exposed in any other part of the Province, calculated by Faribault to be 16,000 feet, and by Woodman 16,900 feet. [1] "North of the settlement, beginning two or three areas beyond the Cooper lead, the rocks are chiefly quartzite for nearly 3 miles. Here and there thin slate strata are intercalated, but the proportion of argillaceous material is small. South of the mines, [illegible]ng at the third or fourth tier of areas south of block 1, quartzite stretches for several miles. The exact proximal limits of these

[1] Woodman, Trans. of the N.S. Inst. Sc. XI. Part I. p. 25.

whin zones cannot be given, on account of the few natural outcrops and the absence of artificial openings; but the margin of error is small.

[1]Between these limiting whin areas is a broad belt characterized by lustrous black slate, often somewhat schistose; essentially differing from the slate of the Halifax formation, which is well exposed on the road north from the mines. There are quartzite strata within this zone, but they are comparatively few and narrow. In them, as in the more abundant ones to the north, slate lenses with rounded edges are occasionally found. It is the extent of this slate belt, at least 1,500 feet wide across the strike, which constitutes one of the unique features of the district. All the ore-bearing veins are situated in it, even though many of them lie at the contact of slate with thin strata of quartzite. On the published plan Faribault indicates a slate zone extending from the Little North to the Comstock lead, a distance of 750 feet.

The structure of the rocks of this district is much complicated by the converging of two main anticlines and the development of subordinate folds, and by several faults crossing the strata in a north and south direction. [1]The Fifteenmile stream and the Beaver dam anticlines converge as they approach this district from the east and are here only 450 feet apart, with two minor plications between them. The folds have a general east and west course. The most northerly, which is the most important, has a north dip increasing gradually from 45° to 80° and its axis has a pitch to the west at an angle of 10°. The fissures on the south side of the south fold dip south at an angle averaging 60°, and the axis has a pitch to the east at an angle of 15°, and the minor intervening plications lie at an angle seldom higher than 45°. These minor folds probably flatten out and are lost at no great distance to the east and west, while the main anticlines converge into one some distance to the west of the district. The numerous folds produce the result that sediments of no great thickness stretch over a wider zone than is usual with strata of similar thickness of the gold-bearing series and between No 7 in area 170 on the north and the veins in the centre of area 970, block 4, on the south, the total thickness involved is only about 370 feet. The main lines of faulting have a general course varying from N. 10° E. to N. 25° E. (magnetic), with displacement from a few feet up to 165 feet, generally towards the north on the east side. In addition to these, minor faults are constantly being met with. These are in every conceivable attitude, some along the plane of stratification, or along the planes of cleavage, the most, however, transverse to both. Their displacement is slight, and as they generally exercise a compensating rather than a cumulative effect, they do not alter the structure of any portion of the district to an appreciable extent. The geological structure as interpreted by Faribault is represented on the published plan of the district.

Some considerable time was spent by Woodman in a detailed study of this district, and his map published in 1904, although slightly more detailed, corresponds closely with that published by the Geological Survey in 1898. In his report [2]the structure is described in minute detail, the district being divided into four sections by the main faults and the folds in each being described, along with such evidence bearing on them as could be obtained from a study of the outcrops and of the rocks exposed in mining operations. The faults, which in this district are not radial in character, were closely studied and described under the headings: course, details of displacements, limits of dislocation, and location and character of movement. Owing to the lack of determining evidence there is necessarily in many cases considerable speculation.

[3]The slates are found to be composed chiefly of kaolin. A small amount of chlorite is revealed by the microscope. Locally the slates are altered into knotted schists, the knots being distributed in the direction of cleavage and consisting of calcite, quartz grains, or indeterminate masses looking almost like decomposed feldspar. The quartzites are composed chiefly of well rounded grains of quartz cemented by silica

[1] Faribault. Geol. Sur., Can., Ann. Rep., X, 113 A.
[2] Trans. of the N.S. Inst. Sc. XI, Part I, pp. 18-88.
[3] Trans. N.S. Inst. Sc. XI, Part I, p. 26.

and calcite. The microscope revealed no feldspar and very little kaolin except in the finer whin. There is quite a lot of muscovite and biotite, some of which is evidently secondary, but some of which, especially of the biotite, was of clastic origin.

The planes of fissility are parallel to the general strike of the rocks, but the quartzite very little, and it is usually on weathered surfaces that the incipient fissility in the latter has been brought out. The quartz grains show no elongation and the secondary minerals do not appear to form distinct bands giving schistosity or cleavage. In the slates the fissility results chiefly from a rearrangement of the kaolin, so that it lies in the cleavage bands rather than in those of stratification. It is aided, but probably not formed, by secondary minerals. Those rocks which in the hand specimen appear most schistose, even the fine knotted schists mentioned above, have only a slightly larger amount of secondary material, the schistosity being due to a microscopical wavy cleavage that seems to be crenulated without much regard to the knots of quartz or other minerals. It is this crenulation which, in part at least, gives the lustrous and silky appearance to the schists.'

Character of the Deposits.

With the exception of one or two small unimportant veins that cut the strata at small angles, all the veins worked in this district are of the interbedded type. With these are connected the angulars, which cut the strata but usually have a strike similar to that of the interbedded veins. The veins show the usual corrugations and rolls so characteristic of Nova Scotian gold veins.

[1] 'The gangue in the veins of Moose river is chiefly quartz with some calcite. Most of the leads have shown only quartz, and the cross veins appear to have no other gangue. The Little North has much calcite, and a few others have large amounts erratically distributed; but in no case does it form the main part of the lead. It is mixed with the quartz without apparent system, sometimes occupying the whole width of the vein, again next the country rock, often in the centre; or in a few instances interbanded with quartz in distinct layers. . . .

'The quartz is rarely cellular or drusy. A few druses show very distinct crystal faces on the walls. The cellular portions of the gangue are especially white, or are rusted by decomposition of a sulphide. Normally, however, the gangue is dark and ribbony, and uniformly dense. The gold is associated with this type, on the whole, more than with any other.'

Although considerable work has been done on the south anticline and on the two minor folds, the most important veins are those worked on the north dip and on the crown of the northern anticline.

Most of the veins, as has been pointed out, lie in the stratification planes, and in their folding and faulting partake of the peculiarities of the sediments. While in most districts the veins lie in narrow slate beds inter-stratified with whin and are found in contact with the whin, in this district the slate is very abundant and the veins are frequently found at horizons where there is no quartzite for a wall. Notwithstanding this, the proportion of veins that break across from one bed to another is exceedingly small, and where such does occur it is within narrow limits, so that the lead is confined to a narrow belt of slate just as in the case where there are whin walls. Sometimes only a portion of the vein crosses the bedding and the lead thus becomes bifurcated. In some instances a belt is found to be composed of a series of intermeshing angulars, without any single lead that is strictly interstratified. The best example of such belt is the Kaulback belt, opened in 1901.

The corrugations and rolls have here the same effect on the country rock as in other districts, sympathetic folding taking place, but rarely extending more than 2 feet from the lead. Both joints and cleavage are turned from their course where they approach the crest of a corrugation, the joints being broadly curved and the cleavage sharply.

[1] Woodman. Trans. N.S. Inst. Sc. XI, Pt. I, p. 59.

Following is a brief description of the most important leads [illegible] district

Copper lead, two veins 3 and 4 inches thick in a slate belt of [illegible] feet.

Little North, two leads with 2 feet of rock between them comp[illegible] of slate with a little quartzite. This gives towards the ends 2 fe[illegible] crushing material.

Little South, a thin corrugated lead with soft slate adjacent to it [illegible] a foot of crushing material.

Big North is in a belt with a whin hanging-wall. The vein w[illegible] lies on this wall is 4 inches thick at the west, thickens to 8 inche[illegible] wards the east, where it is called the North Sutherland, and at the [illegible] end thins again to 5 inches. Rolls dipping to the west are promi[illegible] at the west end.

The Serpent varies from 2 to 18 inches in thickness and is extre[illegible] well but unevenly corrugated.

The Kaulback belt consists of two veins 2 feet apart at the su[illegible] but starting to diverge at a depth of 12 or 15 feet and being 5 or 6 [illegible] apart at a depth of 170 feet. At various points they break up [illegible] stringers which sometimes reunite.

The Comstock, 5 to 7 inches, with rolls, has been traced from [illegible] end of the district to the other, and shows the displacement of the [illegible] faults.

About a mile west of the main deposits is the West mine, w[illegible] several leads have been opened, some of which show distinct rolls [illegible] ing west.

Other less important veins are indicated on the plan publ[illegible] in 1898, and since its publication a number of new leads have been f[illegible] and some of them worked more or less.

History.

[1] It is said that gold was discovered in this district in 1866 by [illegible] lumbermen engaged in blasting rock from the river, and the 'Crit[illegible]' of September 8, 1893, in quoting the Truro 'News,' states that the [illegible] covery was made by John Pulsifer, St. Andrews, and the Messrs. T[illegible] Musquodoboit, this being the John Pulsifer who made the discov[illegible] Mooseland. Mr. D. Touquoy took up some property, but it was no[illegible] 1876 that the place aroused any interest. In that year the distr[illegible] surveyed and prospecting was carried on.

In 1877 the prospects were bright. The yield from a little fl[illegible] dipping north, and owned by Mr. Hiltz, was very encouraging. [illegible] principal mining was done on a south dipping lead on area 25, [illegible] a shaft was sunk to a depth of 30 feet. The next year a double [illegible] 2 inches and 5 inches was traced from area 172 across areas 173 a[illegible] and on to 126, and some portions of this yielded over one ounce [illegible] ton. Exploration trenches in its vicinity failed to reveal mo[illegible] three small lodes. A 7 inch lead was uncovered south of the Co[illegible] giving a yield of 17 hundredweight. An attempt was made to w[illegible] alluvium, but it did not prove satisfactory. 'For this purpose [illegible] about half a mile long was made, and two flumes, each about 200 [illegible] long, were built. The sluice in which the washing was done w[illegible] 300 feet long, but had not the fall that was desirable to clear [illegible]

Some fair returns were made in 1879, a lot of 29 tons from [illegible] giving 32 ounces, and 135 tons from area 172 giving 137 ounces. [illegible] several lodes received attention. Mr. Cole sank two shafts and [illegible] the Little South and Sutherland North lodes, and late in the [illegible] Messrs. Foster and Cole reopened the Comstock lode. Messrs. W[illegible] and Dunbrack worked on area 131, and Mr. Taylor and others [illegible] on a lode presenting the form of an anticline pitching east and [illegible] a subordinate syncline on the apex. Mr. Sutherland worked on th[illegible] side of the road on a flat lode dipping north. Some discoveri[illegible] made by Mr. Zwicker a mile to the west.

In 1881, D. Archibald worked the Walton lode and Mr. To[illegible] worked on area 131 and at other points. Mr. Cole continued operations.

[1] Rep. Dept. of Mines, N.S., 1896, p. 36.

Taylor lead and underlying veins [illegible] M[illegible]

Serpent lead. Touquoy gold mine. Moose river.

PLATE XXVII.

Serpent head M[illegible]

See p. 192

but later in the year his areas and the Foster property and mill were purchased and preparations were made for work on a large scale. The purchase was probably made by the Moose River Gold Mining Company, Ltd., which was organized this year. The following year this Company made preparations for extensive work, the Foster mill was united to a new mill, giving twenty stamps in all driven by steam; a Frue vanner was put in for treating the tailings and an air compressor and other very expensive machinery erected. Two shafts were sunk on the North Sutherland lode to depths of 150 and 200 feet respectively, and regular stoping was carried on. Work was done on the Comstock and other

In 1888, Mr. Touquoy sank two shafts on the Little North lead to the of the Sutherland lode, and for a great many years he persistently carried on economical and profitable mining.

In 1883 Mr. Touquoy sank two shafts on the Little North lead to the west of the property of the Moose River Gold Mining Company, Ltd. This Company suspended operations and let the North, Comstock, and other leads to tributers. Henry Archibald did some prospecting at the west end of the district.

For many years tributing was successfully carried on on the property of the Moose River Gold Mining Company, Ltd. In 1884, Messrs. Taylor and Walker worked the North, Copper, and Little North leads. In 1885, the Little North was worked on tribute, and the following year, it and the Copper lead.

In 1884 Mr. Touquoy worked the Little North and Copper leads in the spring, and later in the season sank 30 feet on the North lode. The following year he did some prospecting and was rewarded by the discovery of an 8 inch lead yielding about 1 ounce per ton. In 1886, he worked the Little North, Copper, North, and South leads, the last being a saddle vein pitching to the west. This year Mr. Bruce prospected the Taylor and Archibald properties and worked two small rich veins on the latter.

In 1887, mining was carried on by Messrs. Touquoy, Bruce, and McGregor. Mr. Touquoy worked the South lead, the Serpent, and the North. This year he started the erection of a 15-stamp mill to be driven by water power furnished by the Moose river, from which, by means of a dam, an 11-foot head was obtained. A dam at the foot of Long lake, a short distance to the north, retained a supply of water in this reservoir sufficient to provide power continuously. Wm. Bruce worked on the South lead on the areas adjoining Mr. Touquoy's, and Mr. McGregor worked on the property of the Moose River Gold Mining Company, Ltd., crushing at a 10-stamp water-power mill, just north of the district. The next year Mr. Touquoy's mill was completed and a lot of surface material was crushed, while tribute work continued on the other properties.

For several years this district continued to be a steady producer, Mr. Touquoy crushing a large amount of surface material in addition to the quartz from the veins, and tribute work being conducted on the property to the east, chiefly by Messrs. McGregor and Bruce.

In 1893, Mr. Touquoy employed twenty men on the Copper and Taylor leads, and a large quantity of slate with small quartz veins was crushed. A. McGregor had twenty-two men at work on the property of the Moose River Gold Mining Company, Ltd. This Company is frequently designated the Montreal Mining Company. The next year four tributers were at work on this property: Robert Russell with six men, Andrew McGregor with three men, James Dull with six, and Charles Stevens with four men. The same year Mr. Touquoy continued operations.

In 1895, Mr. Touquoy worked the North and Copper leads and crushed a lot of surface material, while during the next year the North lode was idle, but about 600 tons per month were taken from a 6 foot belt of low-grade ore. Tributing continued on the Montreal property in 1895, Arthur Higgins employing thirteen men, H. Wilson, six men, and Robert Russell six men in a 70 foot shaft on the Copper lead. The next year this property was worked by A. McGregor with twelve men, and John Reynolds with ten men worked the Little Copper lead. McGregor also did some work in an old shaft east of the Touquoy property and John Reynolds

took up some claims east of the Touquoy property and sank two shafts about 15 feet deep, one on a 3 foot belt and the other on a 5 inch lead. Nathan Higgins also employed three men on Reynolds' property on what is known as the Canaan lead which had been opened 12 years previously.

In 1897, John Reynolds was manager for the Touquoy Gold Mining Company, had thirty-two men employed, and was taking ore from the Little North lead and the Britannia lead on which a 100 ounce pocket was found. [1] It is said that during the previous seven years gold to the value of $110,000 had been won from this property. Operations at the Touquoy mine present an excellent example of economy in gold mining. The 15-stamp mill was driven by water-power, and in [2] 1890 surface material running from 75 cents to $1 per ton was profitably milled, the whole expense connected therewith being only 40 cents per ton. [3] In 1894 the yield was 342 ounces from 4,131 tons; in 1895, 405 ounces from 5,170 tons; and in 1896, 629 ounces from 5,887 tons. Work continued on the Britannia lead in 1898 under the management of J. A. Fraser, and two Frue vanners were put in for concentrating.

In 1897, J. K. Pearson did some work on Donald Archibald property, one mile west of the Touquoy property, and in a trench 600 feet long had exposed 14 leads, varying in thickness from 3 to 12 inches, and 5 belts, 3 to 9 feet wide. George Cameron opened two belts, 3 feet and 16 inches thick respectively, on some areas owned by John Emmett and S. Smith, east of the Touquoy property. A. McGregor worked on the Montreal property, on a large belt on the east side of the road, between the Emmett and Touquoy properties. The next year he was engaged in quarry work and had reached a depth of 60 feet. The whole of the 26 foot belt was crushed, although it yielded less than $2 per ton; the mode of mining, however, is cheap and the ore was crushed at the 10 stamp water-power mill.

In 1898, the Colonial Mining Company had five or six men employed, and quarrying was carried on under the management of J. K. Pearson. The rock and surface material were crushed at a 10-stamp mill, built near the river south of Touquoy's mill. In May, the next year, the mill was destroyed by fire and after that exploration by trenching was prosecuted and a number of veins were discovered.

David Patriquin was manager for the Touquoy Gold Mining Company in 1899 and 1900. In 1899, the Britannia and the Serpent leads were worked, and in the following year a larger number of men were employed and the Little North lead was reopened. Not only the 15-stamp mill, but also the 4-drill air compressor was driven by water-power.

An 8-stamp mill was erected in 1899 by the Reynolds Bros. Gold Mining Company, and open-cut mining was done on a belt on the apex of an anticlinal fold. The belt in the north limb was 4 feet thick and nearly all milling material.

On the Moose River Gold Mining Company's property A. McGregor continued his quarry work in 1899 and 1900. In 1899, some tributers were also sinking on the Moleskin lead and had carried a shaft to a depth of 50 feet.

In 1900, the Colonial Gold Mining Company—Robt. Kaulback, superintendent—sank a shaft on a new lead a short distance from the Touquoy areas. The following year this property and that of the Touquoy Gold Mining Company were operated by the same staff, with Robert Kaulback as manager. On the Touquoy property a shaft was sunk which cut at a depth of 60 feet a 'large slate fissure belt' containing two quartz veins, and 46 feet east of this shaft a shaft was sunk on the same belt on the Colonial property. On both properties cross-cuts were driven and on the latter the New lead was cut in a cross-cut driven to the south.

In 1902, R. Kaulback continued work for the Touquoy Gold Mining Company, and the shaft on the 'slate fissure belt' was continued on an angle to a depth of over 200 feet and at a depth of 180 feet a raise was made to meet a shaft driven from the surface in the Doull lead. A

[1] Can. Min. Manual, 1897, p. 201.
[2] The 'Critic,' Nov. 14, 1890.
[3] Can. Min. Manual, 1897, p. 201.

shaft was sunk 90 feet on the Doull lead and a cross-cut was driven to the Colonial shaft. A new shaft was sunk on the Taylor lead and a cross-cut 125 feet long connected this with the Touquoy shaft. This year the Colonial Company's areas were bonded to Gladwin Bros. and work commenced in August under the management of J. Reynolds. W. Reynolds did a little tributing on the Moleskin lead and A. McGregor on the Montreal property.

The old workings on the Touquoy Gold Mining Company's property were practically abandoned in 1904, and a new shaft was sunk 108 feet west of the Doull or main shaft and 28 feet south of the outcrop of the Britannia lead. In this shaft two leads were cut, and cross-cutting was started. The next year R. Kaulback, manager, did more cross-cutting drifting, and stoping.

In 1904, the G. and K. Gold Mining Company erected a 40-stamp mill and conducted operations on the old Colonial property, working an open-cut on the Joe Taylor belt, which is thought to be the Britannia on the east side of the fault. They also sank a shaft 170 feet deep on the Bruce belt, also known as the Meagher belt. The next year levels and cross-cuts were driven and some ore stoped. A cross-cut driven north intersected the Archibald lead. Work continued in 1906 under the management of W. C. Guilford and the shaft on the Meagher belt was carried to a depth of 289 feet. Driving and stoping were carried on until the middle of March and in July work ceased, but was resumed later.

Early in 1906 the property of the Touquoy Gold Mining Company passed into the hands of Robert Kaulback and others and work commenced in July. The mill was repaired and the next year 268 ounces were extracted from 1,255 tons, taken chiefly from No. 3 belt, which averages 7 feet in width and is composed of heavily mineralized slate and quartz. W. H. Gladwin operated a part of the year on tribute.

In 1907, the Consolidated Mines of Canada, Ltd., mined the property formerly owned by the G. and K. Gold Mining Company, and 219 ounces of gold was extracted from 2,895 tons of ore. In May, work was temporarily discontinued, but in October the shaft on the Meagher belt was unwatered. A cross-cut to the north cuts the Minnie Miller, McCallum, Catherine, and Archibald leads. In 1908, fifty-five men were employed, under the management of W. C. Guilford, and 844 ounces of gold was recovered from 8,326 tons of quartz and slate. Operations were conducted at the Meagher belt, the West shaft, Cameron or East shaft, and the Root-Hog lead.

The Minnie Miller and McCallum leads were stoped, a shaft sunk on the Root-Hog about 100 feet south of the crusher, and on the Cameron lead, a short distance north of the Moose River crusher, a shaft was sunk and short levels and a cross-cut driven. In the western part of the district on areas known as the Johnson areas, a promising lead had been cut in 1907, and in 1908, W. C. Guilford sank a shaft on the adjoining areas to cut it. The lead was not cut at a depth of 60 feet and the shaft was allowed to fill with water.

The Kaulback property was worked about three months this year and produced 31 ounces of gold.

In 1909 the Consolidated Mines Company of Canada, Ltd., carried on operations at different periods at the Archibald shaft on the Archibald belt recovering 539 ounces of gold from 6,344 tons of ore. The No. 3 belt on the Touquoy property was worked this year under the management of M. R. O'Shaughnessy for M. J. O'Brien, and 539 ounces of gold was recovered from 3,135 tons of ore

General Development.

The extent of the operations can be learned from the published plan for which the survey was made in 1897. The following notes taken from the report of the Department of Mines, N.S., will give some idea of the work of more recent years:—

1902. The Touquoy Mining Company.—"A new shaft 90 feet deep has been sunk during the year, on the "Doull" lead, and from 50 feet to the bottom a block of ore 15 feet wide has been worked out on the east side.

'At this 50 foot level a drift is in 20 feet west, and a cross-cut [illegible] been driven north 27 feet to the Colonial shaft.

'The Touquoy shaft, 30 feet west of the Colonial shaft, has be[illegible] tinued on the large slate fissure for over 200 feet.

'At 180 feet, an upraise has been made to meet a shaft [illegible] from the surface on the Doull lead.

'A block of ore has been stoped here for about 50 feet in leng[illegible] 30 feet high. . . . . .

'At a depth of about 70 feet a new shaft on the "Taylor" lead h[illegible] been connected with the Touquoy shaft by a cross-cut 125 feet long

1904. Touquoy Gold Mining Company. A new three-compa[illegible] shaft was sunk 109 feet west of the "Doull" or No. 3 shaft, an[illegible] a depth of 122 feet a cross-cut was driven south, which cut three belts [illegible] ore.

1905. Touquoy Gold Mining Company. The vertical shaft w[illegible] tinued to a depth of 185 feet, and another cross-cut driven at a dep[illegible] of 170 feet for a distance of 125 feet north and 107 feet south

'At a distance of 45 feet south from the shaft a drift was [illegible] 45 feet, and intersected the ore-shoot containing the corrugated [illegible] which had been worked from the surface down to a point 12 feet [illegible] the end of this drift. A [illegible] was made to connect with the old [illegible] ings, and the small body of ore remaining above was worked [illegible] winze also was sunk here for a depth of 25 feet to follow the "[illegible]" on its pitch, southwesterly. A horizontally inclined fault, which [illegible] the strata below the fault plane about 8 feet to the north, was [illegible] tered in this winze.

'Farther to the south in this cross-cut two drifts were ma[illegible] first 55 feet east and 25 feet west, and the second a few feet ea[illegible]

1905 and 1906. A shaft on the Meagher belt worked by the G[illegible] K. Co. had, in 1906, reached a depth of 239 feet on an inclinatio[illegible] and at a depth of 150 feet levels had been driven each way about [illegible] A cross-cut had also been driven north 212 feet.

1907. This belt was being worked by the Consolidated Mines [illegible] ada, Ltd. The 150 foot level was then 80 feet east and 110 fe[illegible] while the 225 foot level was in 60 feet east and 100 feet west. [illegible] latter level and from a point 38 feet west of the shaft a cross-cut [illegible] driven about 70 feet cutting the Minnie Miller, McCallum, [illegible] and Archibald leads.

1908. Consolidated Mines of Canada, Ltd.—Work was done [illegible] the Meagher, Minnie Miller, and McCallum belts. Levels were [illegible] follows: Meagher, east 75 feet and west 64 feet; Minnie Miller, [illegible] 161 feet and west 75 feet; McCallum, east 98 feet and west 95 feet. [illegible] was conducted on the last two leads, and the main shaft was carried to a depth of 325 feet.

A shaft was also sunk 112 feet on the Root-Hog lead, [illegible] short distance north of the Moose River crusher a 100 foot shaft [illegible] on the Cameron lead, a level driven west 30 feet at the bottom, a [illegible] cut from this level north 28 feet. This Cameron lead is about 18 inch[illegible] wide, carries much mispickel, strikes N. 70° E., and dips sou[illegible]

1909. M. J. O'Brien.—'On No. 3 belt, so-called, a winze [illegible] sunk 55 feet, from the 200 foot level, and a level driven west [illegible] the belt to the west for the total distance has been stoped pract[illegible] the floor of the level above. In going west at 106 feet a fault [illegible] pitching to the southwest: no belt has been found west of [illegible] The level east, on No. 1 belt, has been extended 87 feet, and a cross-cut has been driven north 63 feet and south 37 feet. Sev[illegible] leads have been cut in this cross-cut, including the Minnie Miller [illegible] paying ore was found.'

A great deal of work has been done at different times by [illegible] a plicated slate belt in which a great many corrugated quartz [illegible] were found. Owing to the cheapness of quarrying a large q[illegible] slate was crushed giving satisfactory returns. Careful sampling of su[illegible] a body would doubtless result in more remunerative operations.

The production is included with that of Caribou.

MOUNT UNIACKE.

Location.

Mount Uniacke gold district is situated in Hants county, 3 mile north of Mount Uniacke, a station on the Dominion Atlantic railway. It is situated on the ridge that separates the waters flowing into the Atlantic ocean from those flowing into the Bay of Fundy, the elevation of the highest point of the district being 550 feet.

Geology.

[1] The strata form a closely folded anticline having a general course N. 81° E. (magnetic) and continuing eastward through the Renfrew district, 17 miles distant. The strata on the north limb dip north at an angle of 60° and on the south limb vertically, while the anticline plunges to the east at a rather high angle and to the west at a low angle forming a dome of which the centre lies in a swamp on area 712. On the south limb of this dome a subordinate bulge or flexure in the strata radiates from the centre and extends south for a distance of 3,000 feet. On this undulation the outcrops of the strata form pronounced curves, but assume a comparatively straight course on each side towards the east and west. This subordinate flexure is of considerable importance as affording fissures along the stratification planes favourable for the deposition of ore.

The horizon of the strata exposed on this anticline is estimated to be 12,500 feet below the base of the Halifax formation. There is in this district a greater thickness of continuous quartzite than in any other district. A short distance south of the Nuggety lead is a 230 foot belt of quartzite free from slate, and a short distance farther south is a 420 foot belt of quartzite with only a few thin beds of slate. [2] In a section made in block XII by August Michel in 1869 a 380 foot belt of quartzite was found.

There are several more or less important faults. In the western part of the district a left-hand fault, giving a horizontal displacement of 1,085 feet to the anticline at the head of Coxcomb lake, runs north and south through Coxcomb lake and separates the main productive portion of the district from the western portion containing the group of veins and belts uncovered by Mr. Michel. A series of five small faults affects the continuity of the Borden, Little, Nuggety, West Lake, and Polkinghorn leads on the Prince of Wales and West Lake properties. Another line of disturbance, probably running north and south, occurs 800 feet west of the undulation on the south limb and twists the strata 80 feet to the north on the western side. The Nuggerty, McPhail, Bunker, and South leads are also cut by two faults running northwest on the secondary undulations of the south limb. In the eastern end of the district are two left-hand faults in the vicinity of Alpha brook. The eastern one runs S. 51° E. (magnetic), crosses Alpha brook directly east of Alpha lead and the main road 400 feet west of Alpha brook, and gives a horizontal displacement of 200 feet at the anticline. The other runs probably S. 27° E. (magnetic) and gives a displacement of 40 feet on the Nuggety lead, between two shafts 130 and 150 feet deep on the eastern pay-streak, worked on the P. C. F. property.

Character of the Deposit.

All the veins developed in this district belong to the interbedded class and are found on the south limb of the anticline. A few veins have been uncovered on the north limb, but none have been worked and that portion of the district does not offer a very promising field for prospecting as the drift covering it has not been found auriferous.

There are two well-defined zones of veins, one running south from the centre of the dome a distance of 3,000 feet and following the course of the secondary undulation on the south limb, and the other extending

[1] Faribault. Geol. Sur., Can., XII, 175 A.

[2] Hind. Report on Mount Uniacke, Oldham, and Renfrew Mining District, p. 77.

east and west nearly parallel to the anticline at a distance of 600 f[illegible] south of it at the west and 400 feet at the east. This zone is [illegible] but has a total length of 6,300 feet or more extending from Alpha [illegible] to about area 813, block 1. It is a zone of small crumples and and includes many of the most productive veins of the dist[illegible] is the Nuggety, South, Bunker, Prince of Wales, West Lake, and [illegible]

A few veins have been uncovered 1,100 feet east of Alpha brook [illegible] diately south of the anticline. At the western end of the district [illegible] veins have been exposed on the south side of the anticline bet[illegible] the West Lake Property and Coxcomb lake on block 1; while be[illegible] Coxcomb lake and west of the big fault a large number of veins w[illegible] exposed by Michel on block 12 varying in width from 1 inch to 2 fe[illegible] many of which were found to be auriferous. All of those at the weste[illegible] end of the district were found north of the 300 foot belt of [illegible] zite, which is undoubtedly a continuation of that occurring [illegible] Nuggety lead.

On the undulation on the south limb one hundred and thi[illegible] tinct veins or belts of veins have been uncovered or operated [illegible] greater or less extent, giving a total of 172 feet of quartz or [illegible] ore. Proceeding from area 678, block 2, southward, we cross [illegible] lowing most extensively worked veins.

Leads or belts.	Thickness in inches.	Distance from centre of dome in feet.	Deepest works in feet.	Length opened in feet.	Remark
Twenty-foot	240	100	Not worked.		Holds mineralized streaks.
Eight foot.	96	210			
Nichols.	14	250	75	200	
Three-foot.	34	275	Not worked.		Cut by cross-cut at 110 [illegible]
Scotch belt	48	300	"		
Number Three.	10	400	260	400	Rich streak at 110 foot level, cross cut 180 foot south, and 100 feet north. At 150 feet level, cross at 150 feet south
Cook.	10 96	420	110	800	
Cross Tunnel belt	18	438	160		
1st P. C. F. slate belt.	120	450	180	400	Belt 18 feet wide; rich streak [illegible] feet, ore dips east angle 25
Murray	6	470	160	600	
Cut Lead belt	12	500	135	400	Rich streak on Cut lead
2nd P. C. F. slate belt.	60	510	50	300	Belt 18 feet wide, 5 leads, [illegible] dip east.
		545			Line between C. P. F. and the Montreal propert[illegible]
Logan.	8	600	100	300	
1st Montreal slate belt.	120	622	65	95	Belt 20 feet wide; rich streak; 10 feet ore; dips east.
2nd Montreal slate belt.	100	660	90	80	Belt 16 feet wide; rich stre[illegible] 9 feet ore; dips east.
Contract	4	710	105	1000	With other leads was also worked in open-cut 25 feet w[illegible] and 15 feet deep.
		875			From 710 to 875 [illegible] worked by shallow [illegible]
South	3	875	65	1500	This and the next tw[illegible] constitute the east and west [illegible]
Bunker.	4	890	200	3400	Worked to shallow depth [illegible] great length.
Nuggety	4	1000	247	6000	Four streaks worked 150 [illegible] and 110 feet deep.
McPhail	4	1070	140	600	Shoot dips east.

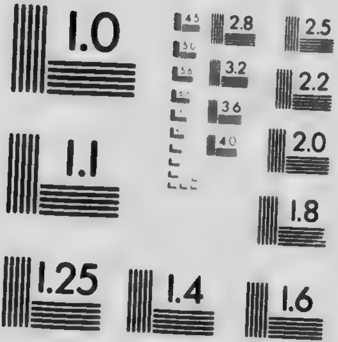
Leads or belts.	Thickness in inches	Distance from centre of dome in feet	Deepest works in feet	Length opened in feet	Remarks
Iron slate belt...	72	1115	40	400	Between 1,115 and 1,380 feet band of coarse quartzite with several white banded veins of no value; no slate
		1380			
[illegible]	6–24	1405	140	1000	Affected by four faults at east end
[illegible] belt.	15	1440	50	400	Two leads, 6 and 9 inches in the belt
		1870	..	...	Between 1,440 and 1,870 feet coarse quartzite; several veins of no value, only one worked [illegible]; no slate
Howe belt...	60	1870	40	50	Belt 6 feet wide, short streak dips east, 3 feet ore
Dimock belt..	72	1885	240	400	Belt gives 14 feet ore on a rich streak (half crushing material) dipping east.
Robertson belt ...	33	1900	240	400	Belt of three leads, 3, 24, and 6 inches wide, on a rich streak dipping east and worked with the above belt for a length of 400 feet from the surface
		1960		.	Between 1,900 and 1,960 [illegible] leads cut by cross cut, [illegible]ing 12 inches not worked
[illegible] belt......	36	2155	80	160	Belt of three leads.
McQuarry belt ..	60	2175	40	150	Large belt
Galena	6	2235	50	200	
N. McIntosh	3	2555	80	250	
Dowell belt.....	12	2600	40	......	Belt of three leads
S. McIntosh	6	2640	60		
Dimock So. belt.	9	2660	60	500	Belt of three leads
Toronto.......	4	2925	55	100	
Hayes slate belt...	8	3000	25	100	Workings farthest south

In this north and south zone of enrichment the pay-shoots dip to the east at angles varying from 25° to 35°. In the long zone extending east and west it is also found that the pay-shoots dip to the east. The South lead, 3 inches thick, and the Bunker lead, 4 inches thick, have been worked at intervals by many small shafts, seldom reaching 60 feet, and by open-cuts for a length of 3,400 feet. One pay-shoot on the Bunker lead, dipping east and formed by angular veins dipping south-east, has been worked on the Prince of Wales property to a depth of 200 feet. The Nuggety lead was uncovered for 6,000 feet and four important pay-shoots have been worked; one at the east end of the P. C. F. property, dipping east at an angle of about 35°, was worked 150 feet deep; 1,000 feet west of it another, dipping east at an angle of 26°, was worked to the eastern limit of Mr. Henry Hogan's Montreal property, proved very rich to a depth of 247 feet, and is said to still carry good ore; 2,700 feet farther west, a rich streak, probably dipping west, was worked to a depth of 200 feet; and, 1,100 feet still farther west, the last pay-shoot dipping east at an angle of 24° was worked in connexion with [illegible] other leads on the West Lake property to the vertical depth of [illegible] feet and found very rich.

[illegible] the western part of the district on this last-named property the pay-shoots are determined by a secondary crumple lying 650 feet south of the main anticline. The axial plane of this crumple dips to the north causing an enrichment in the leads where it crosses them. The

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc

rich shoots worked on the West Lake, Nuggety, Little, and Bord[illegible] occur where they are folded in this subordinate crumple, the leads becoming thickened and the quartz occurring in rolls. The [illegible] on the Borden lead plunges east at an angle of 18°. As the a[illegible] of the crumple dips to the north the rich shoot of each successive [illegible] is found to the north of and at a greater depth than that of the [illegible] immediately south. Numerous quartz stringers pass upward fr[illegible] apex of the crumple of one vein to the trough of the crumpl[illegible] next vein to the south, and, although these stringers are genera[illegible] ren themselves, they seem to serve as feeders to the vein ab[illegible] cause an enrichment at the lines of intersection. [1] The producti[illegible] gold from the West Lake and Nuggety crumples is 1,142 ounces [illegible] 1,472 tons crushed, and from the Borden crumple 2,991 ounces from 2[illegible] tons crushed

History.

[2] A discovery of auriferous quartz veins was made in this dis[illegible] on the farm of the Hon. Richard J. Uniacke by Messrs. David Mac[illegible] tosh, John Sims, and Charles Sims, on June 18, 1865. Many [illegible] were taken out and the prospect was so promising that before the [illegible] dle of 1866 more land was held in this district under leases and [illegible] pecting licenses than in any other in the Province. In 1866, a [illegible] crusher was erected and a road was built from Uniacke station to [illegible] crusher. The following year this road was improved and exten[illegible] two more crushers were erected, and such a rapid growth took pla[illegible] the mining industry that, while the production for 1866 was rep[illegible] as 72 ounces, that for 1867 was reported as 1,622 ounces. In Decem[illegible] 1866, there were only two houses on the field, but a year later [illegible] were more than fifty, and over two hundred residents. Prosp[illegible] was easy on account of the thin covering of drift, but this r[illegible] growth was ascribed by some to 'secret influences, and partially [illegible] ported crushings.'

A number of men and companies were at work here in 1867 [illegible] the exact location of their workings is difficult to ascertain, a[illegible] early reports of the Department of Mines, Nova Scotia, make no [illegible] tion of the names of the veins. During this year a Mr. Mitchell [illegible] two shafts 35 feet apart on one lode. West of him Mr. Burkner [illegible] two 25 foot shafts on another lode and commenced stoping; whil[illegible] farther west and on the same lode as Mr. Burkner was working, [illegible] foot shaft was sunk by Mr. Doull and stopes carried along the [illegible] on each side. The Montreal Company worked the Logan lode by [illegible] shafts and the Mount Uniacke Company sank three shafts o[illegible] lode to the east of the Logan lode, besides opening two lodes fa[illegible] south. Some distance to the west of these operations Messrs. Ha[illegible] McAllister opened a 10 inch lode by two shafts, 50 feet and 35 fe[illegible] while still farther west the West Lake Company mined a lode, o[illegible] an aggregation of lodes, the width of which was about 9 feet.

The year 1868 saw a rapid increase in operations and the prod[illegible] reached the high-water mark for this district—3,247 ounces. Most [illegible] numerous companies engaged during the preceding year continued [illegible] tions this year and their number was increased by several addit[illegible] companies. The veins worked by these companies are not known [illegible] but the areas held, together with the returns to the Mines Offic[illegible] the dates of these returns, are recorded in Hind's Report on M[illegible] Uniacke Gold District. The Mount Uniacke Company continued [illegible] and the main shaft reached a depth of 190 feet, while others w[illegible] feet deep. Driving levels, stoping, and cross-cutting were [illegible] Montreal Company, who held a property extending from ar[illegible] and 617 east to areas 813, 814, and 815 inclusive, block 2, open[illegible] 47 feet south of the Logan lode and another 7 feet still farther [illegible] sinking and stoping on both, while directly to the west th[illegible] Company sank shafts on a 6 inch lode. The Prince of W[illegible]

[1] Faribault. Geol. Sur., Can., XV, 182 A.
[2] Heatherington. Guide to the Gold Fields of Nova Scotia, [illegible]

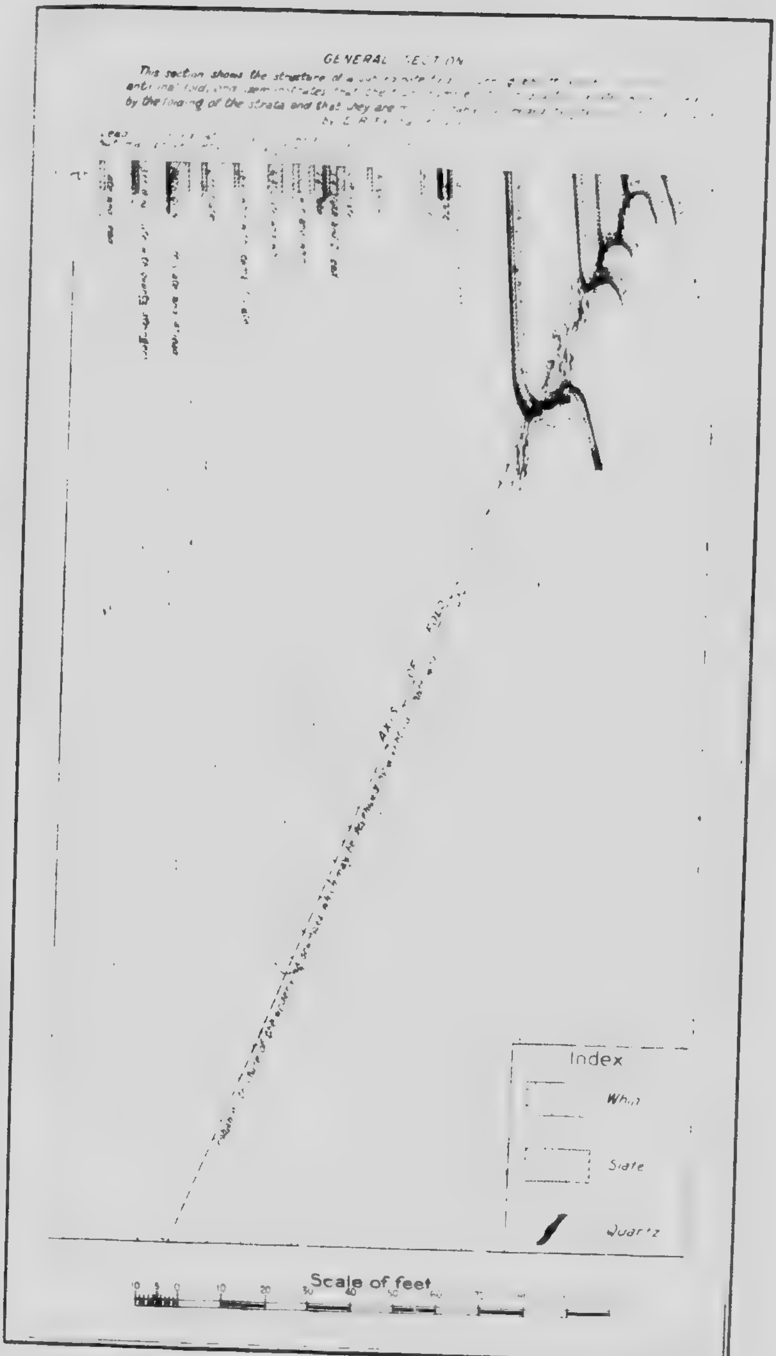


FIG. 6. Transverse section of West Lake mine, Mount Uniacke.

p. 200

pany, whose property lay next to the westward, did some work on a 5½ inch lode; while still farther west the Queen Company opened four shafts on each of two lodes lying in a range of areas, including and extending westward from areas 219, 220, and 221. One of these lodes had been opened the preceding year by Messrs. Hall and McAllister. The West Lake Company opened its vein by three shafts, the deepest being upwards of 50 feet, and these were connected by a tunnel from which the lode was stoped to about 6 feet from the surface. The Imperial Company did a little work on some areas farther west than the West Lake Company's property in block 1, while Messrs. McNab & Co. sank a shaft on a lode about 200 feet north of the West Lake lode, and at a depth of 44 feet some cross-cutting was done. Some work was done on two veins by the Brunswick Company, who held a portion of land of which the corner areas were 213, 218, 345, and 356, block 2, and work was continued by the Union Company on the lode opened by Mr. Donll south of the Central Company's property. Mr. Burkner continued operations this year, and the St. Lawrence Gold Mining Company and D. Touquoy also reported a small amount of gold.

The year 1869 saw a marked decrease in mining activity which reflected itself in the production. The production rapidly decreased year after year until in 1874 only 14 ounces were reported. The probable cause for this is given in the Report of the Chief Commissioner of Mines for 1870 in which he says: 'There has, perhaps, been no district so much injured by the speculating mania of 1867 and 1868 as this one. Properties that were of moderate size were cut up into two or three, and sold to speculators. In some cases crushers were built, not with the expectation of mining, but to sell stock. The result has been litigation, disappointment in making sales,and stoppage of the works.'

In 1869, the Mount Uniacke Company continued operations with profit to the owners; the main shaft was continued to a depth of 230 feet, and a cross-cut, driven 135 feet on the 110 foot level, intersected several veins. The other companies that made the most important returns for the year were the Montreal Company, the Central Company, and the Queen Company, while the work of others in this district was chiefly of an exploratory nature.

In 1870 the Uniacke Company was the only one that kept continuously at work, reporting 501 ounces of the total production of 566 ounces. The Queen Company took out a little quartz and the West Lake mine was reopened. In 1871, the Uniacke, the Montreal, the West Lake, and the Queen properties were worked on a small scale, and the next year a few tributers removed some easily accessible quartz from various properties. In 1873 and 1874, tributers did a little work, and in the latter year the production fell to 14 ounces.

After this the production steadily increased until in 1882 it reached 1,786 ounces. In 1875, the miners living in the district worked the outcrop of the leads on the property of the Montreal Mining Association, chiefly on the area 682, block 2; while the principal work in the latter part of the year was done on area 678 by the Uniacke Gold Mining Company under the management of Mr. Prince. In 1876 the greater part of the gold obtained was reported by Messrs. Hogan and Barsalou from area 780, block 2. This year Mr. McClure resumed operations on a vein intersected by the 150 foot cross-cut on the property of the Montreal Mining Association. New machinery was put in and the mill was repaired, but he was unable to make the mine on area 614 pay working expenses and reluctantly abandoned sinking in 1877. During this year several tributers were at work, but the most promising discovery was made on the Toronto property, area 755 (?), where a 3 inch lead was opened, which yielded 4 ounces per ton.

In 1878 the most successful mining was done by Mr. McIntosh on area 717, and the Montreal, the Queen, and the Prince of Wales properties received some attention. In 1879 the North and South lodes were worked and various tributers carried on operations on other lodes. In 1880, the Bunker, Mitchell, and McPhail lodes were worked on the Montreal areas by stoping from the shafts and by open-cuts, while the West Lake property was also worked. In 1881 there was increased activity. The Nugget lode was worked by Mr. Blois, while Messrs. Davidson, Herbin, and others were

engaged on its eastern extension. Mr. Prince continued working the slate belt on the Uniacke property; the West Lake property was worked by Messrs. Bayne and others, and the Bunker lode on the Prince of Wales property by Mr. Foster, who carried a light 5-stamp mill.

In 1882, the Nuggety lode was worked by Mr. Blois and Mr. Prince, the latter of whom resumed operations on the slate belt towards the close of the year. The large slate belt on the Montreal property was reopened and extensively worked; the Galena lode was worked by Mr. Lee; and Mr. Davidson sank a 200 foot shaft on a 12 inch lode. In 1883 Mr. Davidson continued his work; Mr. Blois worked for some time near the pond and later turned his attention to the slate belt on the Montreal property. Mr. Prince worked the Uniacke property and reopened the eastern extension of the Nuggety lead, while Messrs. Madill and Brown also carried on limited operations. The next year Messrs. Davidson and Prince continued operations, and some tribute work was also done on the Montreal, Union, and other areas. The year 1885 saw Messrs. Davidson and Prince still at work. The production of 1886 fell to 320 ounces and that of 1887 to 107 ounces. In the latter year several properties were bought up by the British and Colonial Land Association and preparations were made for carrying on extensive work on low-grade ore by the erection of a 20-stamp mill, Frue vanners, and a power plant. Little seems to have been done, for in 1888 the production of this district was again very low and in fact it has seldom risen to any important figure since then.

In 1889, the Phoenix Land and Development Company, Ltd., was incorporated, and under the management of H. B. Prince some sinking was done, and in 1891 the shaft had reached a depth of 230 feet on a belt of low-grade ore. In 1891, the Messrs. McCallum made a rich strike near the old Alpha property and ore was taken out, which was crushed at the Phoenix mill. Interest was also revived in the West Lake property and it was worked a while. In 1892, the C. P. F. Mining Association was formed to acquire the property of the British and Colonial Land Association, and work was started by open-cut on a low grade belt, and continued for several years. In 1896, F. R. Prince was manager, and sixteen men were employed on a belt which furnished 16 feet of milling ore, yielding about 2 hundredweight per ton. The ore was crushed at a 10-stamp mill. In 1897, however, nothing more than a little tribute work was carried on in this district.

In 1901, this district was once more the scene of activity. The National Mining Company—John Kenty, manager—had eighteen men employed on the Prince of Wales lead which they had reopened in July, 1900. The Queen lead, 123 feet south of the Prince of Wales lead, was also reopened and a 2-stamp Tremain crusher was used for testing. In 1901 this Company returned 266 ounces of gold, and in 1902, 79 ounces. In 1901 the Great Belt Mining Company was organized to reopen the old quarry works on the property known as the British American. The large open-cut is divided into two parts by a belt of whin several feet thick and operations were resumed in the north division which is about 30 feet wide, the north half of which is a 15 foot slate belt intercalated with small quartz veins. In 1902, under the management of T. Prince, the open-cut had reached a depth of 120 feet and a length of 80 feet, and the ore was crushed at a 30-stamp mill which had just been completed. This Company reported a production of 254 ounces from 3,095 tons in 1902, and 35 ounces from 300 tons in 1903.

On July 1, 1902, work was started on what was supposed to be the Nuggety lead on J. A. Johnson's property several hundred feet east of the West Lake mine, and in the same year the Royal Mining Company did some sinking on a slate belt thought to be the Chittick belt on some areas north of Johnson's. In 1903 the work on Johnson's property was managed by Geo. E. Johnson, who had four men sinking. This sinking continued during 1904 and 1905, under the management of G. Johnson, with the expectation of cutting a crumple similar to that found in the Borden lead on the West Lake property. At a depth of 200 feet a small roll was intersected and driven on for a few feet east. In 1905 the shaft was 400 feet deep and cross-cutting above that depth was started northward.

By far the most important operations in this district in recent years were those on the old West Lake property in which Messrs. Archibald and Crease were interested. The work consisted chiefly of mining and milling the rich pay-shoot that followed the crumple of the Borden lode. A crumple on the West Lake lead was mined with great profit in 1868, and later some sinking was done on the Borden lead, but this was abandoned before the rich ore was struck. This lead was reopened in 1901 under the management of J. Bryson, and 606 ounces of gold was extracted from 587 tons of ore. Work was steadily carried on in 1902 under the management of D. Patriquin, the pay-shoot being followed and the ore crushed at the old Madill 8-stamp mill. The production reached its maximum this year, being 1,659 ounces from 703 tons. In 1903, J. A. Crease had eleven men employed, and in 1904 Mr Crease was still manager. This year the shaft was sunk 65 feet deeper and a cross-cut driven north 15 feet with the expectation of finding crumples on other veins lying to the north of the Borden. Only two small stringers were cut, however. In the autumn of this year the plant was destroyed by fire, but was rebuilt; and in May of the following year the new plant was also destroyed by fire, apparently of incendiary origin. In 1905 the workings were abandoned.

In 1906, J. A. Crease had five men employed on what is known as the Whin-bound lode, and in 1907 and 1908 he made returns to the Mines office. In 1908 returns were also made by J. A. Johnson.

General Development.

Regarding the extent to which operations have been conducted on the different leads, the reader is referred to the published plan and to the paragraph on "Character of the Deposits," where the depth of the workings is given. This is one of the districts in which an attempt was made to mine low grade deposits by open-cut, and a great proportion of the rock and quartz of some large belts was milled. The large belts of mineralized slate and quartz which have been operated on the P. C. F., the Montreal, and the Phoenix properties have been found to carry regular values on the north and south zone of enrichment, and they still present a very promising field for extensive mining of low-grade ore.

In no part of the district has mining been carried to any great depth, and it seems probable that in many cases the workings have not been carried to the bottoms of the pay-shoots. It also seems probable that in zones of special enrichment other pay-shoots parallel with those already worked and underlying them occur either in the same vein or in adjacent veins. The crumple already described as cutting the West Lake, Little Nuggety, and Borden veins probably extends to greater depth and produces rolls in other veins farther north which might be worth exploring.

Production.

(Including Moose Unacke and South Uniacke.)

Year	Gold extracted			Ore crushed	Yield per ton of 2,000 lb.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1866	72	16	9	28	2	12	0
1867	1,[illegible]2	13	20	1,968	0	16	12
1868	3,217	6	17	3,871	0	16	16
1869	1,867	3	12	3,172	0	11	18
1870	506	11	5	1,794	0	6	7
1871	360	17	3	900	0	8	0
1872	241	10	0	364	0	13	7
1873	129	8	18	198	0	13	1
1874	14	1	0	19	0	14	10
1875	139	3	3	319	0	8	17
1876	227	14	10	321	0	14	4
1877	663	15	9	470	1	8	6
1878	629	5	7	794	0	17	21
1879	787	18	0	744	1	1	4
1880	1,161	16	12	1,505	0	15	10
1881	1,355	8	21	3,094	0	8	23
1882	1,786	4	9	3,440	0	10	12
1883	1,197	15	0	2,809	0	8	12
1884	1,140	6	2	2,235	0	10	4
1885	576	0	12	2,010	0	5	7
1886	320	17	3	1,263	0	5	2
1887	107	3	1	689	0	3	2
1888	632	7	1	612	1	0	16
1889	1,390	11	9	2,296	0	12	2
1890	1,612	2	13	2,525	0	12	18
1891	2,965	5	4	1,751	1	13	20
1892	2,300	0	14	786	2	18	12
1893 (9 mos. ending Sept. 30)	905	11	5	644	1	8	12
1894 (Year " " ")	1,394	8	1	1,544	0	18	1
1895	2,535	13	13	3,516	0	14	10
1896	3,732	0	15	5,092	0	14	16
1897	2,274	4	4	2,344	0	19	9
1898	1,779	6	23	1,899	0	18	17
1899	984	17	0	1,770	0	11	3
1901	874	9	0	748	1	3	9
1902	1,992	19	23	3,895	0	10	6
1903	893	2	22	1,390	0	12	20
1904	975	19	18	2,349	0	8	7
1905	99	11	15	38	2	12	10
1906	246	11	15	161	1	10	17
1907	143	15	0	25	0	15	0
1908	21	19	4	22	0	19	22
1908	53	8	15	(Mortared).			
1910	41	17	23	90	0	9	7

OLDHAM.

Location.

Oldham gold district is situated in the northern part of Halifax county about 25 miles north of the city of Halifax and 3 miles east Enfield, a small station on the Intercolonial railway.

Geology.

The district lies near the summit of the watershed that separates the streams flowing into the Atlantic through Porter lake from those whose waters reach the Bay of Fundy by the Shubenacadie valley. The elevation of the centre of the district is 317 feet. The Goldenville formation is exposed in a subordinate anticline 9 miles long lying on the south limb of the Shubenacadie-Grand Lake anticline. The intervening syncline lies half a mile north of the Oldham anticline. The fold, which follows a ridge, is transversely symmetrical and the strata dip in both directions at angles varying from 50° to 80°. The fold plunges to the east at angles increasing to 45°, and 3 miles east of the district flattens out and disappears; it plunges to the west at an angle great enough to completely conceal the Goldenville formation by the Halifax formation at the railway bridge on the inlet of Shubenacadie-Grand lake.

The dome has suffered much faulting, esepcially in the eastern part. An important fault follows the axis of the anticline, and attempts to trace veins around the apex of the dome past this fault have met with poor success. Radiating from the dome towards the southeast is a series of important right-hand faults, two of which have horizontal displacements of 97 and 120 feet. On the north limb are a few small breaks. A few flat faults have been met in underground workings. Most of the faulting has been later than the formation of the veins, but the Baker vein in the eastern part of the district occupies a fault plane.

Character of the Deposits.

The most productive part of the district is the eastern end of the dome, that part that has suffered most from faulting. Nearly all the productive veins are of the interbedded type, although the Baker vein in the east and the Britannia vein on the north limb, both of which proved highly auriferous, are cross veins. Among the most important interbedded veins may be mentioned the Dunbrack, Sterling, Boston-Oldham, North Wallace, South Wallace, and Donaldson; great numbers of others have been worked and many of them with profit.

The pay-shoots follow the rolls, which are quite prominent in the veins in the southeastern part of the district and dip to the east. On the Dunbrack lead a very persistent and rich shoot was worked to a depth estimated at 1,200 feet on a dip increasing gradually from 23° to 40°. The rich shoot on the Sterling Barrel lead has been worked 1,525 feet on the dip varying from 30° to 43°. In the northeastern part of the dome a number of veins such as the Boston-Oldham and Frankfort proved rich on their curve towards the apex of the anticline. Some veins have been worked extensively on the strike. Some leads north of the centre of the dome were enriched at the intersection of angulars from the southwest. In the Blackie vein the gold was concentrated in arsenopyrite pockets, some of which carried as much [illegible] ounces of the precious metal. Other veins in the southwestern [illegible] district have proved productive.

This is one of the oldest dist[illegible] Province, and one in which the production has been very stead[illegible] [illegible]n only one year, 1896, did the yield fall so low as to be included by the Department of Mines, N.S., under the heading "Other Districts." This is due to a certain extent to the large amount of tributing that has been done here.

[1] "In the spring of 1861, when public attention throughout the Province was excited by the confirmation of the report of the discovery of gold at Tangier, two men: Edward Horne, of Elmsdale, and Samuel Isner, of Gays river, who had in their hunting excursions observed a large boulder of white quartz in a densely wooded tract, about 3 miles east from the Truro road, determined to examine it, for the purpose of ascertaining whether it contained gold.' They succeeded in finding some small sights, and on their discovery being confirmed and made public several

[1] Rep. Chief Gold Commissioner, 1862, p. 17.

persons commenced prospecting in the vicinity. Amos Hough found gold about September 1 in a brook $1\frac{1}{2}$ miles southwest from Horne and Isner find, and a mile east of Hough's a discovery was made by Edward McDonald and Donald McKenzie, who brought the matter to the attention of the government. The free claim was awarded to Horne and Isner.

Considerable prospecting followed and in 1862 a number of leads were opened and active mining operations commenced. On the Barrel lead running through area 314 a shaft was sunk 80 feet deep. Increased activity was noticeable in 1863, additional areas were taken up, and five new stamp mills were erected, making a total of eight mills in the district. The activity continued through the following year and 1,750 ounces of gold was reported, one small lot of quartz giving the phenomenal yield of 10 ounces per ton.

This period of activity was succeeded by several years of comparative depression, the yield for that decade reaching its lowest level in 1868, when it fell to 719 ounces. In 1866 and 1867 the principal mining in the district was done by the Boston and Oldham Company, but in June of the latter year this Company ceased operations. They did some work in the barrel quartz section and on a lode farther north sank shafts and did some stoping. In 1866, a Mr. Lockhart did some work in the district. In 1867, Mr. Schaffer started work and was the chief operator in 1868. He did some work on the Britannia lode, but his activities were confined chiefly to mining barrel quartz. In 1868, Mr. Bunker sank three shafts near Schaffer's property, and old workings on the Ohio lode were reopened by Messrs. Fraser and McBean. The same lode was opened a little farther west by Mr. Donaldson. Mr. Donaldson continued operations during the following year, but Messrs. Fraser and McBean closed down.

The year 1869 saw a renewal of activities in this district, and many old workings were reopened. Some exploratory work was done by Messrs. Oakes, Pearson, Bayne, Woodruffe, and others. The Ritchie lead was reopened by Captain Coxetter, and Messrs. McDonald and Schaffer worked a lode, containing barrel quartz and lying to the east of the Barrel lode which Mr. Schaffer had previously worked. The principal operations, however, were carried on by the Sterling Company, which had acquired several abandoned properties, and sinking and stoping were conducted on the Barrel lode on which Mr. Schaffer had worked, and on the Frankfort, Wallace, and Ritchie leads. This Company continued to be in 1870 the principal operator, working the Barrel, Frankfort, and Blue lodes, and continuing on the Barrel lode in 1871. A new shaft was sunk, and crosscuts were driven, cutting in addition to others, the Sutherland and Harrison lodes. Next to the Sterling Company the St. Andrew's Company was the most important and it reopened the Symonds lode which had been worked formerly by the Boston and Oldham Company, and worked it until late in 1871, when it was closed. Besides these Mr. Donaldson and a few others did a little work. This year, 1870, there were three crushers in operation, two driven by water-power and owned, one by Robt. G. Fraser and the other by the Oldham Company; the third was driven by steam and owned by the Sterling Company.

Except for the St. Andrew's and the Sterling Companies the principal returns for 1871 were made by Doyle and Horne and R. G. Fraser. This year Mr. Schaffer started work on the Britannia lead, but on striking a fault and failing to pick up the lead in a 30 foot cross-cut, he directed his energies to the McKenzie lead, which he pumped out by power from the Napier mill. In 1873 he did a little work on the Ritchie lead.

Mr. Donaldson continued to work in 1871 the lead he had opened and he remained an active operator here until 1876, when his mine on areas 130 and 131 was transferred to Mr. McClure.

The Hall lead on the Sterling property was worked a little in 1873 and steadily in 1874, during which year some little work was done on the Whitehead, Britannia, and Blue leads.

More men were at work in this district in 1875. The principal work was done by Mr. Donaldson on areas 130 and 131, and by Mr. E. McDonald on areas 322 and 323. The Hall lead was worked in the early part of the year by Mr. Schaffer, and later by Mr. McAllister and others.

The Frankfort lead was reopened in June by Messrs. A. McDonald and Company, and the Dunbrack and Barrel leads were also reopened.

In 1876, the Donaldson property, known as the Bonanza, on areas 130 and 131, was transferred to Mr. McClure and work was resumed in the autumn after much money had been spent in making alterations and repairs. Unfortunately the mine had to be abandoned the following summer. In 1876 further attention was given to the Angling lead, area 533; and the Wallace, areas 337, 339, and 341, and the Frankfort, areas 321 and 322, were mined. The Blackie was worked this year and in the spring of 1877. Tributers worked in 1877 on the Hall lead and on the Angling leads of the McKenzie and Sterling properties; a shaft was sunk on the Blue to test its intersection with the Britannia; and the Hay or Nugget was worked to a depth of 80 feet. In 1874 a 60 ounce pocket of gold was found in the last lead, but the rest of the quartz was almost barren. The production of this year was greatly increased by T. N. Baker's discovery of a very rich lead on areas 627 and 628, from which 1,280 ounces were taken in 5 months.

Mr. Baker erected an 8-stamp mill and work on this important lode was carried on until 1881, when operations ceased and some new lodes were prospected.

A rich spot was struck on the Britannia lode in 1878, but the next year Mr. Donaldson discontinued his work there and turned his attention to the Hall lode. In 1879 some work was done on the Frankfort and Wallace lodes. In 1880, Messrs. Doyle and McDonald worked an angular on the Sterling property and work was continued by the Messrs. Donaldson, who also opened a serie of lodes a short distance south of the Mayflower mill in 1881. This property was worked the next two years. In 1882, Mr. Baker opened a large cross vein and worked it during this and the following year, and during these two years some tribute work was done on different properties, but interest in the district seems to have flagged and the production fell to a very low ebb, especially [illegible] 81 and 1882, when 329 ounces and 411 ounces respectively [illegible] ed.

In [illegible] McDonald sank a 100 foot shaft on a barrel lode near the Sterling property and stoped out a portion of it; while some tribute work was done by many, among whom was E. C. McDonnell, who continued his shaft the next year to a depth of 200 feet and then closed down in the autumn to erect a steam power plant for more efficient pumping and hoisting.

In 1881, J. E. Hardman mined successfully a belt of low-grade ore and made preparations for mining the Fraser, Lowell, and Baker properties together and reopening the main shaft on the Baker lead. The next year he opened a rich lead west of Mr. McDonald and completed arrangements for pumping and hoisting at his main shaft by electric power generated a half mile distant by the water-power by which his crusher was driven. The Dunbrack lode came in for a great deal of [illegible] tion in 1886, being worked on different properties by J. E. Hardman, [illegible] C. McDonald, and Messrs. Donaldson. Hardman did some sinking and drifting and obtained some good quartz; McDonald obtained ore from the bottom of his workings, yielding 3 ounces per ton, and sold out to Mr. Hardman the next year; th[illegible] ssrs. Donaldson, who had done a little work the preceding year [illegible] ended their shaft to a depth of 95 feet.

Mr. Hardman worked the Mayflower and Dunbrack leads in 1887, and for several years continued to be the principal operator in the district. Mining was brisk and returns usually ran between 2,500 and 3,000 ounces. In 1890 the two leading companies were the Oldham Gold Company and the Standard Gold Company, the personnel of both of which consisted of J. E. Hardman, Oldham, N.S., and Frederick Taylor, Lowell, Mass. Operations were conducted on the Dunbrack lode by the Standard Gold Company and on the Baker and Dunbrack by the Oldham Gold Company. The latter Company erected a new 10-stamp mill in 1891, at which the quartz from the mine of the Standard Gold Company was also crushed. These two Companies and the Napier Mining Company, Ltd., were all under the management of J. E. Hardman. In 1892 the Napier Company sank a vertical shaft 113 feet deep on the

apex of the anticline on area 102, cutting seven lodes that do not crop at the surface. Two of these were said to be sufficiently aurif[illegible] as to justify further development. At a depth of 100 feet cross-cuts w[illegible] driven 100 feet each way and levels were started on different le[illegible] In 1893 active mining was still carried on, this year under the m[illegible] agement of W. J. McIntosh, and during the first nine months [illegible] official returns for the district were greater than for any other y[illegible] in its history, being 3,171 ounces.

[1] The official returns from the mill of the Oldham Gold Compa[illegible] are as follows:

Year	Ore crushed.	Yield
[illegible]	925 tons	1,700 [illegible]
1886	928	2,164
1887	2,3[illegible]	2,[illegible]
1888	2,107	1,6[illegible]
1889	1,393	2,7[illegible]
1890	1,126	2,775
1891	1,789	2,447
1892	2,232	[illegible],089
1893	2,534	3,[illegible]
1894	918	736

A comparison of these returns with those of the whole distric[illegible] shows that the Oldham Gold Company's mill was producing nearly [illegible] the gold of the district during these years. [2] The Dunbrack vein [illegible] during these ten years, the most productive, and from it several phen[illegible] nal yields were recorded: in August, 1895, 125 ounces from 2·4 tons; in [illegible] 1,037 ounces from 37 tons and 530 ounces from 12 tons; in 1891, 757½ ou[illegible] from 48 tons and 1,084 ounces from 88½ tons; and in August, 1893 [illegible] ounces from 2 tons. In July, 1895, work had ceased, and the product[illegible] was low for several years.

In the early nineties two or three other companies erected sta[illegible] mills and carried on operations, among which may be mentioned [illegible] Concord Gold Mining Company and the Columbia Gold Mining C[illegible] pany, but little resulted from their work.

In 1899, H. F. Donaldson pumped out and retimbered the Bon[illegible] mine and did some stoping. M. R. O'Shaughnessy had eleven men [illegible] ployed on the Blackie lead, and a number of men were prospecting [illegible] tributing in other parts of the district. Tributing continued du[illegible] the following year. T. N. Donaldson and others reopened the Do[illegible] lead, southeast of Hardman's deep shaft, deepened the shaft and [illegible] some stoping. Edward Whidden and Company, who had unwatered [illegible] Sterling lead in November, 1899, and retimbered it, sank the north s[illegible] an additional 70 feet and stoped out some of the quartz.

In 1903, the Columbia property was reopened by L. E. Daloz for [illegible] New England Gold Mining Company. A cross-cut driven 410 feet [illegible] the north intersected several leads, including the Wallace, North W[illegible] lace, Powell, and Worrell. Tributing has been carried on more o[illegible] intermittently on various leads, but the later history of the district [illegible] to a great extent centred in the operations at the old Sterling [illegible] perty.

In 1903, the Oldham Sterling Gold Company, which had been orga[illegible] ized the preceding year, was working on this pr[illegible] under the m[illegible] agement of E. Whidden. The next year J. B. F[illegible] took the man[illegible] ment of the mine and co[illegible]ued operations until 19[illegible], when the ma[illegible] ment passed into the ha[illegible] of C. V. Brennan. Work was conti[illegible]

[1] Can. Min. Manual, 1895, p. 86.
[2] F. H. Mason, Can. Min. Review, Vol. XIV, p. 154.

Mill of the Oldham Mining Co., Ltd., Oldham.

almost altogether to the Sterling lead, but some exploratory work was done in 1908 on the Blue and the Schaffer barrel leads. The main shaft on the Sterling lead had in 1908 reached a depth of 1,330 feet on the incline or 725 feet vertical depth, the first 500 feet of the incline being at an angle of about 30°, below that running for some distance at about 38°, and at the bottom 41°. Crushing was done for some time at the Taylor-Hardman mill, but a new 10-stamp mill was erected in 1905. After three months' unsatisfactory crushing in this new mill in 1906, the ore was again sent to the former mill. Crushing was, however, resumed in the Company's mill in June, 1908.

Work continued at this mine in 1909 under the management of W. A. Brennan. The inclined shaft was sunk 195 feet farther, so that it is now 1,525 feet deep on the incline. The dip at the bottom is 53°.

The ore proved very rich, the production being as follows:

Year.	Ore crushed.	Yield.
1904	214 tons.	498 ounces.
1905	665 "	1,145½ "
1906	804	1,249 "
1907	362 "	853 "
1908	526 "	2,384 "
1909	940 "	2,710 "

In 1909, the Oldham Mining Company—C. V. Brennan, manager—had twelve men employed on the Schaffer barrel lead. The shaft, which was originally 100 feet deep, was sunk 95 feet farther. From 224 tons of ore 204 ounces of gold was recovered. A number of tributers reported altogether 113 ounces of gold from 209 tons of ore.

General Development.

Not much information along this line is available. The plan of this district was the first one that was compiled by Faribault, and the survey was undertaken to show the structure of the dome and not the extent of the mining operations.

The location and depths of very few shafts are given and we cannot, therefore, judge from the plan as to the extent to which operations were carried on.

In the early days of Oldham's history a great deal of mining by open-cut was carried on, and at the time of the publication of Hind's report on this district in 1872 open trenches exceeded 43,000 feet in length and the whole surface was honey-combed with trenches, shafts, and pits, few exceeding 60 feet in depth.

The published plan gives the depths of a few shafts, and some slight idea of the extent of more recent workings can be got from the historical sketch.

Production.

Year.	Gold extracted.			Stuff crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1862	51	0	0	84	0	12	3
1863	1,223	3	21	1,026	1	4	6
1864	1,750	5	12	2,238	0	15	11
1865	1,126	11	20	2,236	0	10	1
1866	956	12	20	966	0	19	19
1867	1,100	3	14	870	1	5	7
1868	719	0	4	1,012	0	14	4
1869	1,394	16	0	1 735	0	16	1
1870	2,051	15	3	2,644	0	15	12
1871	1,718	12	12	1.374	1	4	4
1872	1,014	11	10	793	1	5	14
1873	998	2	17	662	1	10	3
1874	665	8	11	527	1	5	6
1875	915	8	2	550	1	13	6
1876	1,953	5	23	1,705	1	2	21
1877	2,527	19	13	2,015	1	5	2
1878	1,737	9	9	1,808	0	19	5
1879	1,600	17	0	1,787	0	17	22
1880	829	4	17	1,475	0	11	[illegible]
1881	329	10	4	604	0	10	21
1882	411	6	12	690	0	11	18
1883	999	17	8	1,253	0	15	22
1884	824	15	12	921	0	17	21
1885	2,360	12	5	1,170	2	0	0
1886	2,199	3	23	1,026	2	2	20
1887	2,599	7	9	2,357	1	2	[illegible]
1888	1,699	9	19	2,106	0	16	3
1889	2,709	0	18	1,391	1	18	22
1890	2,774	13	20	1,122	2	9	10
1891	2,909	10	13	2,019	1	9	0
1892	3,093	13	2	2,259	1	7	9
1893 (9 months end. Sept. 30)	3,171	9	16	2,389	1	6	13
1894	546	17	16	981	0	11	5
1895	489	7	10	594	0	16	11
1897	282	5	6	308	0	18	17
1898	1,329	9	14	631	2	2	3
1899	692	3	18	993	0	13	22
1900	1,379	16	8	1,519	0	18	2
1901	439	11	16	779	0	11	5
1902	565	10	0	719	0	15	18
1903	419	8	23	712	0	11	19
1904	804	9	18	552	1	9	4
1905	1,401	9	18	1,187	1	3	1
1906	1,492	4	18	1,394	1	1	14
1907	893	10	0	495	0	16	[illegible]
1908	2,458	3	0	754	3	5	[illegible]
1909	3,017	14	0	1,373	2	3	2

OVENS.

Location.

The Ovens gold district is situated in Lunenburg county on a small point of land on the west side of Lunenburg bay, and 10 miles by wagon road southeast of the town of Lunenburg.

Cunards cove, The Ovens, where richest placers were found.

9869 p. 210

The Ovens.

a

a
I
c
c
t
l
lo

p
a
es
h
ir
F

in
ma
at

fe
Do
A
lat
all
the
fee
in
to
sou

aba
to
lin
the
spe
of
con
ope
the
a t
som
McC
yea
othe
year

Geology.

The rocks, which consist of slates, form a bluff 50 feet high, facing the sea. The washing of the waves against the bluff wears away the softer beds of slate and forms deep indentations, fancifully called ovens, hence the name of the district.

The slates are closely folded in an anticline that can well be seen on the shore of Lunenburg bay and has been traced westward to Rose bay, where it is also well shown. This anticline pitches east at an angle of 5° and the strata of the north limb dip north 60° to 70°, while those on the south limb dip south between 80° and 85°.

Some distance south of the anticline occur several igneous dykes described as dioritic and running nearly parallel with the strata. These are small, varying from 5 feet to 9 feet in thickness, and probably in no way connected with gold deposits.

Character of the Deposits.

The quartz veins are interbedded and lie on the north limb of the anticline. Unfortunately these are only from a fraction of an inch to 1 or 2 inches in thickness and cannot be worked profitably to any great depth. The most important is the Bent lead consisting of corrugated quartz. A short distance to the south of this is the Dowling lead and to the north lie the Campbell, Trauenwizer, McCulloch, and Tucker leads. A number of angulars dipping west 60° to 90° enter the Bent lode and make it auriferous at the line of intersection.

The most of the gold from this district was derived from the shore placers. The wearing of the bluff and debris from the bluff by wave action led to the concentration of the gold in the sands on the shore, especially in the crevices in the slate over which the sand was washed by the waves and shore currents. The richest placers were found in the immediate vicinity of the anticline in Cunard cove and in Rose bay. Farther south the sands of the shore furnished low-grade washings.

History.

The Ovens was one of the first places in which gold was discovered in Nova Scotia and in the early sixties there was a considerable interest manifested in the district, but since then it has failed to attract much attention.

The discovery that aroused the public interest was that of an auriferous quartz vein three-fourths of an inch thick discovered by James Dowling on June 13, 1861. This was on the promontory called the Bluff. A number of land areas were taken up, but when John Campbell, a month later, discovered gold in the sand on the shore, attention was turned to alluvial mining. In 1862, three or four areas were still being worked, but the deepest pit on any vein was 33 feet, none other being deeper than 23 feet. The alluvial washings on the shore were pretty thoroughly worked in 1861, but were still remunerative in 1862, and it was estimated that up to the end of the year 1862 about 2,000 ounces had been obtained from this source. That constitutes the bulk of the total production of the district.

In 1863 very little work was done and nearly all the lessees had abandoned their workings. The Chief Gold Commissioner in attempting to account for this, expressed the opinion that it was due partly to the limited size of the areas and to the reckless expenditure of money in the erection of costly hotels, stores, and shops, which should have been spent in the introduction of up-to-date mining machinery. The spring of 1864 saw a resumption of work, but it was almost immediately discontinued. The depression continued through 1865, but in 1866 limited operations were carried on by McCulloch & Co. and Mr. McDonald. By the former, several shafts 30 to 60 feet deep were sunk on a 5 inch lode; a tunnel was also driven 140 feet in from the shore. Mr. McDonald sank some shafts on the Bent lode south of the lode worked by McCulloch & Co. McCulloch & Co. ceased work early in the spring of 1867, but during the year some work was done on the Bent lode by Messrs. Fairchild and others, who continued operations during the early part of 1868. This year some lodes were opened and worked, to a slight extent, by Mr. Drew,

who also erected a furnace for roasting the quartz. In 1869 almost the only mining done was that carried on by Messrs. McKay and Ross on the Bent and other lodes opened on the McCulloch areas. Work was entirely suspended the following year, and except for a little prospecting the district has since received slight attention. In 1896 and 1897 some little interest was again aroused, and in 1896 A. J. Cowie reported a yield of 5 ounces from 26 tons, while the following year the Acadia Gold Reduction Company extracted 78 ounces of gold from 210 tons of ore.

General Development.

The placers have been practically exhausted, although it is said that a year or two ago two men washed out $60 worth of gold in 15 days.

The Bent lead has been worked more than the others, altogether a length of 3,000 feet, but chiefly by open-cut and shallow shafts, the deepest of which was 65 feet—the Blossom shaft. The Campbell, Trauenwizer, and Dowling were also worked by open-cut, but none of them very deep. On the Trauenwizer a tunnel was driven from sea-level along the vein 140 feet. Attempts have also been made to cut the leads farther west.

A Chilian mill still stands in this district and consists of two sets of wheels. Each set consists of two white granite wheels 4 feet in diameter and 1 foot thick revolving on a base of white granite 5 feet 8 inches in diameter and 13 inches thick.

PLEASANT RIVER BARRENS.

Pleasant River Barrens gold district is situated in the northwestern part of Lunenburg county on Pleasant river, a branch of the Port Medway. It lies on the road between Bridgewater and Pleasant River, 6 miles from Hemford station on the Caledonia branch of the Halifax and Southwestern railway.

The Goldenville formation is exposed in a broad circular dome, probably a portion of the anticline passing through Brookfield, 12 miles west. The strata dip at angles averaging 40°.

The veins are chiefly of the interbedded type, although a few cross veins have been found carrying gold. [1] They are nearly all along the main road on the northeast and southeast parts of the dome. The few that have been developed appear promising, but no important operations have been carried on yet.

[2] Gold was discovered in the eighties, a great deal of prospecting has been done, and a little crushing. Unfortunately, owing to ignorance of the rock structure, much of the early trenching was in a direction parallel with the leads.

One of the most northerly veins is a 10 inch lead which was opened to a depth of 110 feet. A fourth of a mile southeast of this is the Wade property on which is the McDonald lead, 10 inches wide, strike 87° (magnetic), dip north 30°. On this two shafts have been sunk 75 feet apart, the one farthest north to a depth of 140 feet and the other 100 feet. One-eighth of a mile farther southeast, on the Porter property, is a 20 foot shaft on a 12 inch lead. Some distance farther to the southeast and east of the main road 300 feet is the Dunbrack lead, probably the most important in the district. Here a 10 inch vein striking 355° (magnetic) and dipping east about 25°, lies in a belt of slate 2½ feet wide. A pay-shoot was found at its junction with a north-dipping angular, but elsewhere the vein was barren. A shaft was sunk 40 feet and a level driven northward. [3] It is stated that some quartz from this vein yielded $3,000 per ton. The discovery of the rich shoot on the Dunbrack led to a short-lived boom.

The Field of Gold Mining Company was organized with an enormous capitalization, the big mill was remodelled, and other buildings erected.

---

[1] Faribault. Geo. Sur., Can., XV, 406 A.
[2] Industrial Advocate, VIII, 4, p. 8.
[3] Bailey. Geo. Sur., Can., VI, 19 Q.

Returns from the Dunbrack lead were very encouraging, and work was started on the Pine Tree lead, a short distance west of the mill. Then the pay-shoot on the Dunbrack was lost and mining ceased. This was in the spring of 1891 and the Dunbrack lead was not worked until 1895, when it was bonded from the Field of Gold Mining Company and opened up by J. W. Ferguson and Wm. McNeill. The pay-shoot was recovered and some good looking ore was got out, but an attempt to sell the mine led to litigation and a cessation of mining operations. A little south of the Dunbrack is the S. Ernst mine, a shaft 80 feet deep on a belt of quartz and slate, dipping to the south and carrying 3 feet of crushing material. Half a mile west of this is the Brignell property on which two veins have been opened, a 6 inch interstratified vein and a vertical 3 foot cross vein of white quartz with a strike of 25°.

RENFREW.

Location.

Renfrew gold district lies in Hants county 4 miles northwest of Enfield, a station on the Intercolonial railway, 27 miles from the city of Halifax.

Geology.

[1] The anticline on which this district lies is a continuation to the east, after many subdivisions into small anticlines and synclines, of the Mount Uniacke anticline, and its axis here runs N. 70° E. (magnetic). It crosses Stinking lake at the west end of the district, about its middle, following Number-eight brook down to Ninemile river and becomes concealed by Carboniferous strata at Little Ninemile river.

The fold is unsymmetrical, the axial plane dipping north, and it is the broadest and most flattened elliptical dome met with in the eastern part of the Province. The strata dip at low angles for some distance on both the north and south limbs, the dip increasing gradually until it reaches 50° at a distance of 2,500 feet south of the axis, and 65° at a distance of 5,000 feet; while on the north limb it reaches only 30° at a distance of 2,500 feet from the axis, and it does not exceed 45° farther north, the axial plane, therefore, dips north about 75°. At the western end of the district the anticline plunges at angles varying from 18° to 25°, and thick beds of quartzite stand out in bold relief for many hundred yards, forming long undulating and faulted curves on the end of the dome, near Stinking lake. At the eastern extremity of the dome, in the vicinity of Nine-mile river, the strata curve more abruptly and the fold plunges at an angle of about 20°. The centre of this broad dome could not be exactly located, the northern part of the district being covered by drift for the most part, but it is situated on or near Number-eight brook and at no great distance to the east or west of area 833, block 2.

Extensive erosion has taken place and strata that were originally deposited 8,700 feet below the base of the Halifax formation are here exposed.

Three gentle undulations radiate from the centre of the dome, one southwesterly and two westerly, the middle one of the three being the main anticline. The two western undulations run towards Stinking lake, with strata dipping westerly at angles less than 32°.

The southwestern undulation, which is by far the most important, widens out as it recedes from the main dome, plunges to the southwest at an angle gradually increasing from 0° at the centre to 50° at the extreme limit, and the axis-plane dips north at an angle probably near 75°. On the northwestern side of this undulation, the measures have been subjected to enormous strain and shearing, producing a series of flexures and right-hand faults roughly parallel with the axis of the undulation and giving horizontal displacements ranging from a few feet up to 200 feet.

[1] Faribault. Geol. Sur., Can., XII, 169 A.

Character of the Deposits.

The veins that have been developed are of the interbedded typ Although the discovery of auriferous boulders in the thick drift on th north side of the anticlinal axis has led to some exploration of th north limb, no veins of any importance have been found here. Th strata on this limb dip at angles varying from 10° to 35°, rather lo for the occurrence of paying veins, and at any rate for working narro veins at an advantage. Numerous rich boulders have been found, esp cially on the undulations between Stinking lake and the Rawdon lead but all search for their source has proved fruitless. All the minin operations have, therefore, been conducted on the south.

[1] 'The south de of the southwestern undulation contains the mo extensively oper ed veins of the district. On the south side of th dome, opposite the centre, the strata run on a straight course parall with the axis of the main fold, and they have been tightly compress in the process of folding by a direct lateral force from the south whi has prevented the formation of fissures. But, as they approach th southwestern undulation, they curve gradually round, and, coming und the influence of a new full shearing force, develop in some slate belt numerous fissure-veins. The veins gradually increase in size and i number, until they attain their maximum width on or about the ap of the undulation, forming a zone of fissure-veins which possess all th characteristic features of a promising field for permanent and d mining. Important streaks of special enrichment have been worked many leads along this zone.' They are generally well defined and d to the west at a low angle probably corresponding with the plunge the undulation. This has not been determined, however, owing to th lack of plans of the underground workings. They crop out at the su face along a well-defined line. 'The line of special enrichment runs fro the centre of the dome, on Number-eight brook, S. 47° W. (magneti to Parker brook, some 500 feet below the Rawdon road bridge, thenc curving to the south it crosses the Renfrew brook above the Colon dam and extends to the works on the Andrew lead, which marks abo the extreme south limit of the formation of fissures, on lot 1826, blo 1, giving a total length of 8,500 feet

'In the first 1,600 feet, from the centre of the dome to the Phillip lead at Parker brook, some thirteen leads have been uncovered, most them recently, all lying at angles under 40°, many of which have prov d auriferous and promising, but none have so far been operated.

'The next 1,600 feet of the zone, south of Parker brook, includes succession of twenty-t known veins, comprised between the Phill and the McClure leads, most of them included on the property of th Pictou Development Company. Their length varies from 200 to 1,00 feet, and their average thickness is above that of the veins in m districts in the Province. Proceeding from north to south, the veins which most mining has been done come in the following order and distances stated from the McLeod lead:—

[1] Faribault. Geol. Sur., Can., XII, 171 A.

Leads	Thickness in inches.	Distance from McLeod lead, in feet.	Deepest shaft, in feet.	Length opened, in feet.	Remarks
McLeod	9 to 15	0	300	1,350	Two rich streaks; eastern one dips east, western, west.
Preeper.......	10 to 36	95	125	800	Good strong lead.
Foundation.....	5 to 10	150	400	650	Rich lead, traced west a long distance
Hay..........	9	210	120	600	
Paper Collar...	6	285	150	300	
Kilcup.........	10 to 16	380	50	1,000	
Clements......	10 to 21	460	75	600	Good large belt.
Sims..........	10 to 48	655	112	1,200	Good large belt of constant value.
Johnson........	8 to 36	960	90	1,900	
North Ophir....	12 to 18	1,370	350	1,000	Belt of four leads, rich streak dips west.
South Ophir....	8 to 12	1,510	400	800	Rich pay-streak dips west.
McClure.......	12 to 15	1,585	185	500	Slate belt with quartz

The remaining 2,300 feet of this zone, between the McClure belt and the Andrew lead, contain, as far as the surface developments have gone, only ten leads and none have proved of special value. Rich drift has, however, been found in this section, south of Renfrew brook, but it may come from the leads worked farther north.

On the northwest side of this important southwestern undulation, in the faulted area, numerous quartz veins have been found, some of which are auriferous, but are so faulted and twisted as to make it doubtful if they can ever be extensively worked with profit. Some exceedingly rich ore was taken from the Jubilee vein on a small local undulation in this faulted area. It may be that other veins are enriched where they are affected by this local fold, and possibly the rich float discovered on Parker brook and Rawdon road, immediately north of the bridge, originated from veins similarly affected.

Some 5,000 feet south of the centre of the dome a number of veins have been operated on the Free claim and area No. 2. These occur in an area of local disturbance, where there was some faulting and subordinate folding, and they were worked 150 feet along their course and to depths of 100 to 175 feet. At a depth of 175 feet the formation is thrown to the south about 8 feet by a fault. Some of the veins thin out before reaching this depth, and it has not yet been ascertained whether the paying ore continues below the fault.

'A series of some thirty or forty veins has been uncovered on the southeastern flank of the dome at a distance varying between 2,000 and 5,000 feet directly south of the centre. A few of them have shown gold, but none have been operated. The pay-streaks on this zone probably dip eastward.

'On the eastern pitch of the main anticlinal fold, 4,000 feet east of the centre of the dome and half-way down Number-eight brook, a few boulders of gold-bearing quartz have been found, but all search for the veins in situ has been fruitless, only a few veins of low-grade ore having so far been found.'

History.

William Thompson appears to have been the first discoverer of gold in this locality and is said to have found an auriferous quartz boulder on the banks of the brook near his mill. The excitement incident to the discovery of gold at Tangier led to some prospecting by the residents of Nineveh.

River settlement and John McPhee discovered quartz veins near William Thompson's mill in the summer of 1861. Little attention was paid to the discovery, however, although it was made public, but when it became known that towards the last of April, 1862, Andrew Parker had found an unusually rich quartz vein near Thompson's mill there was a rush of prospectors into the district. On April 29, arrangements were made with the owners of the land to allow mining areas to be laid off and leased, it was immediately proclaimed a gold district, and prospecting and mining started in real earnest. In a few months three crushers were in the course of erection and by the first of November two of them were in operation. Some very rich quartz was crushed this year and among the veins opened may be mentioned the two Free-claim leads, the Prosper on area 343, the Shubenacadie, a lead on the ninth range of areas varying from 8 inches to 1 foot, and one on the tenth range of areas 14 to 20 inches thick.

In 1863, the production was nearly double that of 1862, but was only 785 ounces. Most of the early mining of this district was conducted by operators who held small tracts of land and worked on a small scale, and the first four years of the district's history were not noticeable for any marked production. In 1863, George H. Madill did quite a lot of work on areas 1, 2, 59, and 60, the property of the Hartford Gold Mining Company, and among others who engaged in mining may be mentioned Charles Sim, I. Fleming, A. Cox, and the Chebucto Mining Association.

The year 1864 saw an increase in the production, although no crushing was done during the last three months on account of the drouth. Among the operators this year were F. S. Andrews, the Colonial Gold Mining Company, George Madill on the Hartford Company's property, and H. B. Prince on the areas owned by the Renfrew Gold Mining Company. The total yield of gold in the district during 1863 was equivalent to $203.90 per man employed, while the product for the nine months of 1864 gave $385 per man.

There was a slight falling off in the production in 1865. George Madill continued to work areas 1, 2, 59, and 60; the Ophir Mining Company, first heard from this year, reported 245 ounces from areas 162 to 164 and 197 to 199; and the Renfrew Company and others reported small amounts.

In 1866, there was a very decided increase in production, the gold extracted being about six times that of the preceding year. Many areas passed into new hands, larger holdings were acquired by the operators, new and larger crushers were erected, and mining was vigorously carried on. The Ophir Mining Company was by all odds the greatest producer of the year, reporting over 4,600 ounces; and active mining operations were conducted by this Company on the No. 1 or North and No. 2 or South leads. The New York and Renfrew Company also sank four shafts on the No. 1 North lode west of the Ophir Company, besides working seven lodes on the free claim varying in width from 2 to 18 inches. Messrs. Allen and McClure sank four shafts on a 10 inch lode north of No. 1 North lode and returns were made by Brayton Ives and the New Haven Company.

The year 1867 was the banner year of the district, a production of 7,904 ounces from 7,222 tons making this the leading district of the Province. In point of profit it ranked next to Sherbrooke and the yield for the year averaged $895.30 per man employed. As in the preceding year, the Ophir Mining Company was the principal producer, and reported over 6,000 ounces. Shafts on both the North and South were deepened and stoping was active; while the same Company also opened a 5 inch lode to the south of the South lode. The property of the New York and Renfrew Company had passed into the hands of the Hartford Company, who continued the work on the North lode and on the free claim. Sinking and stoping were done on the McLeod lead by Messrs. Allen and McClure and some distance to the south of the Ophir property a lode was opened by Mr. Andrews.

In 1868, the production dropped to less than half that of 1867 and over 3,000 ounces of this was reported by the Ophir Mining Company, who continued vigorous mining on the North and South lodes as well as on the McClure lode. The Brook lode was also worked and exploratory cross cuts were started from the North and South lodes. Crushing was done at a water power, 16-stamp mill. The Hartford Company did some work

on the North lode, and their successors, the Colonial Company, sank a shaft on the South lode, and stoped out a portion of the McLeod lode, besides doing some intermittent work on the free claim, and opening the Phillips lode about 100 feet north of the McLeod lode. Some stoping was done this year on the lode opened in 1867 by Mr. Andrews.

In 1869, the principal operators were the Ophir Mining Company and the Colonial Company. The former continued operations on the North, South, McClure, and Brook lodes. The shaft on the North lode was deepened to 400 feet and that on the South lode to 342 feet, but work on both of these was suspended late in the year. Little was done on the Brook lode, but stoping was actively conducted on the McClure lode. The Colonial Company continued to mine the North lode until the influx of water from the abandoned Ophir workings compelled it to desist. Sinking and stoping were, however, conducted on the McLeod lode and on an 8 inch lode south of the McLeod. Operations on the free claim were carried on this year by W. Gay.

There was a very pronounced decrease in production in 1870 and no very extensive operations were attempted. The Ophir Mining Company stoped out some of the South lode to the surface, sank two shafts on the Hay lode, and removed some ore by underhand stoping. The latter lode was also mined by the Renfrew Company, and operations were continued on several lodes on the free claim, but principally on the Bayne lode from which ore was hoisted through a 132 foot shaft.

In 1871, about the same production was reported as in the preceding year, and work was carried on by the New Haven Company, the Renfrew Company, the Hartford Company, and the Ophir Mining Company, nearly the whole production being reported by the last two companies. The Ophir Mining Company extracted 625 ounces from 1,436 tons and the Hartford Company 383 ounces from 494 tons. These two companies suspended operations in 1872, and mining in this district was almost altogether abandoned. The McLeod lead on the Ophir property was worked to a small extent on tribute, and the Preeper lead was reopened by other parties after an abandonment of [illegible] years. Production continued to drop off until in 1874 only 3 ounces were reported. In 1873, Mr. McClure did some trenching in the eastern part of the district, and exposed several veins, none of which were very promising. He continued prospecting in 1874, during which year the Preeper lead received a little attention.

For a number of years mining in this district was almost at a standstill and no extensive work was attempted, and the history can be little more than a list of the operators with the names of the leads on which they carried on their limited operations. In 1875, the Preeper lead was worked on areas 342 and 343, the Clements lead on area 319; and a lead overlying the Preeper on area 344 was worked by Mr. Macdonald for the Hartford Mining Company. In 1876, the extension of the Ophir lead on R. G. Fraser's property was taken by a company and reopened, but the results were unsatisfactory. In 1877, Mr. McClure reopened the McLeod lead on area 369 and a little work was done on the Clements lead as well as on areas 318 and 319 on a lead overlying the Preeper. In 1878, work on the McLeod lead was discontinued on account of the quartz becoming thinner and impoverished, and later in the year the Hay lead was worked a little, but abandoned the next year. In 1879, Mr. Haydon reopened the Preeper lode and later on the Old Time lode. A few others were engaged in taking out small blocks of ore from various lodes. In 1880, the Hartford property was reopened, and in 1881, Dr. Rae did some work on the Brook, No. 2, and Bain leads. He was the principal operator in 1882 and mined the Hard, Brook, and Bain leads, but discontinued the following spring.

In 1883, Mr. A. A. Hayward, manager for the Empress Gold Mining Company, started operations in this district and for a number of years was the only important producer. The eastern extension of the Preeper lode was opened, the Ophir mill repaired, a 3-drill air compressor was put in, and other preparations made for systematic mining. Active operations were carried on in 1884, so that although the production of the preceding year was almost nil, this year 570 ounces were extracted from 1,679 tons of ore. In 1885, work at the Empress mine continued although crushing had to be stopped during a part of the season owing to the drouth. A

little work was done this year by Messrs. D. A. McDonald and Rae. I 1886, operations were not so brisk, but in 1887 there was renewed activit and 750 ounces were reported from this district. The free claim was work a short time and then sold to E. C. McDonnell and associates, but th principal work was that at the Empress mine, where overhead stopi was carried on, a large amount of ore blocked out on the Foundati lead, and a cross-cut driven to the Hay lead, from which the ore was t be hoisted through the main shaft on the Foundation lead.

In 1888, the free claim was reopened by E. C. McDonnell and for a fe years returns were made from it and the Empress mine. The free clai was actively mined in 1889 and reported a higher yield than the Empre At the latter mine cross-cuts were completed to the Hay and Preeper lea opening up a large body of ore, and a new water-power 10-stamp mill was erected. The year 1890 saw a greatly decreased yield in this distri and at the end of this year work on the free claim almost complete ceased. The Empress mine owned by Mr. North was under the manag ment of D. S. Turnbull, but the crushings were not so great as in previo years. The Ophir mine was unwatered in 1891, but the result seems not t have been very satisfactory.

In 1894, the Pictou Development and Mining Company, Ltd., was o ganized to acquire and work the properties of the New Haven and Renfr Company, the Colonial Gold Company, and the North Mining Compa In 1895, twenty-five men were employed and operations were carried on the Preeper, McLeod, and Clements leads under the management of D. A McDonald. This Company made returns for four or five years, the larg being 439 ounces in 1896.

In 1900 came a revival of mining in this district, and the producti for four years placed Renfrew again in the group of important minin districts. This was due to the milling of some very rich quartz won fr the Jubilee and neighbouring leads. In 1900, 4,150 ounces were report from 459 tons crushed in this district, over three-fourths of which w returned by E. and C. Thompson and the balance by the Big Five Mi Company. This year twelve men were employed on the Thompson property, a shaft sunk 105 feet, and two levels driven east 44 feet. Work was carr on by the Big Five Mining Company and an old 60 foot shaft was tended to a depth of 110 feet, levels were driven and stoping was d on a belt carrying two veins, one on the hanging wall of about 6 in and one on the foot-wall of about 4 inches, the western continuat of the Jubilee lead. In 1901, under the management of J. D. Horne, shaft was deepened to 156 feet and a third level driven east to the Th son mine. Active operations were carried on by C. Thompson who th year had thirteen men at work. The shaft was sunk vertically for 65 feet and from the bottom was continued 75 feet on the vein. From M 1900, to August, 1901, 5,470 ounces of gold was extracted from 452 ton ore taken from this mine. The Messrs. Thompson continued operati during 1902 with good results although the ore was not nearly so as it had been; small returns were also made by the Big Five Mi Company and by the Warwick Gold Mining Company, operating on so flat leads near the apex of the anticline.

In 1903, the latter Company made small returns, but the prin operations were carried on by the Pictou Development Company on t Thompson property. Most of the stoping was on the Jubilee lead, b 12 inch lead south of the Jubilee received some attention. This Com continued operations in 1904 and the shaft reached a depth of 365 feet, the production was small. The following year work was of a very desu nature and very little gold was reported.

In 1905, the Eagle Mining Company, Ltd.—Otto Kramer, manag acquired the property of the Pictou Development Company, and commenced sinking a shaft on or about area 456 on the Maria Walker lead. In 1906, the shaft was 45 feet deep and levels were driven, but no stoping had l done, although a small production was returned. In 1907, twelve m were employed and a yield of 77 ounces from 538 tons was obtained 1908, no ore was crushed but development and construction work done. A small amount of sinking was done on the Maria Walker l but this was discontinued in August and the reopening, clearing,

retimbering of the old Empress mine claimed the attention of the Company. Operations were carried on during the winter, but the mine was closed early in the spring of 1909. Later in the year work was commenced by Evan Thompson and M. J. O'Brien.

General Development.

As is the case with nearly all the districts, the best idea of the extent of development of the Renfrew deposit can be got from the plan on which the location and depth of the shafts are indicated. The ore has been removed by numerous shafts sunk on the dip of the veins and very little cross-cutting has been undertaken. Operations have been conducted only to limited depths and it seems probable that many of the pay-shoots were not worked out. The zone including the veins lying between the McLeod and McClure leads, although worked out near the surface, offers an especially good field for exploration at greater depth. The Ophir leads were very rich along shoots dipping west and it is the belief of old miners that those shoots were not worked out. The group of six veins lying between the Paper Collar and McLeod inclusive, and comprised within an area 270 feet wide, could be worked advantageously at greater depths by a system of cross-cutting from the 400 foot level of the Foundation lead. There is in this series of leads an *en echelon* arrangement of the pay-shoots, the shoot in any one vein lying somewhat to the east of that in the vein immediately to the south. After the discovery of a shoot on any lead it will be necessary to go east to cross-cut to a vein lying to the north, and west to cross-cut to a vein lying to the south. A similar sysem of operations might be applied to the Clements and Sims leads. The southern extension of the same zone as far south as the Andrews lead is also worthy of the attention of surface prospectors, as it is probable that the drift conceals a series of interbedded auriferous veins lying between the McClure and the Andrews.

Important water-power is available here and has been utilized in past operations. Renfrew brook running along the southern part of the district has several important falls and rapids, and five falls of 20, 35, 15, 15, and 15 feet respectively have been utilized above the main road. Six lakes are available for reservoirs and a great deal of power could be developed both above and below the main road.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1862	308	8	0	171	1	15	10
1863	785	7	7	575	1	7	[illegible]
1864	1,172	6	5	1,229	0	19	[illegible]
1865	1,008	10	18	927	1	1	18
1866	6,423	15	11	6,003	1	1	9
1867	7,904	19	2	7,222	1	2	4
1868	3,573	14	9	5,994	0	11	6
1869	3,097	15	7	7,258	0	8	12
1870	1,171	18	11	3,243	0	7	2
1871	1,179	17	16	2,463	0	9	4
1872	323	3	8	855	0	7	15
1873	59	16	18	255	0	4	16
1874	3	3	7	10	0	6	7
1875	47	16	6	113	0	8	[illegible]
1876	75	14	10	164	0	9	5
1877	207	13	4	294	0	14	[illegible]
1878	155	17	10	380	0	8	5
1879	104	1	20	419	0	5	0
1880	155	14	13	537	0	5	19
1881	269	8	13	583	0	9	[illegible]
1882	196	19	10	418	0	9	[illegible]
1883	....	17	10	3	0	17	10
1884	569	18	0	1,679	0	6	18
1885	639	10	0	641	0	19	[illegible]
1886	233	17	0	428	0	18	[illegible]
1887	750	4	14	1,234	0	12	3
1888	642	16	10	1,145	0	11	6
1889	697	17	15	1,070	0	13	[illegible]
1890	253	10	12	760	0	6	15
1894 (year end. Sept. 30)	590	0	0	757	0	15	14
1895	1,366	17	0	1,242	1	2	0
1896	389	10	0	557	0	13	23
1900	4,450	15	22	457	9	13	22
1901	3,358	5	6	751	4	9	10
1902	1,374	11	1	974	1	8	[illegible]
1903	1,717	2	12	610	2	16	[illegible]
1904	185	0	0	701	0	5	7
1905	36	5	0	512	0	1	[illegible]
1906	62	10	0	217	0	5	[illegible]
1907	75	10	0	538	0	2	[illegible]
1909	45	0	0	180	0	5	[illegible]

SALMON RIVER.

Location.

Salmon River gold district, also known as Darrs Hill, is situated on the eastern side of Salmon river in the eastern part of Halifax county, 4 miles from Port Dufferin. It it distant from the city of Halifax 70 miles by water and 95 miles by post road, and from Shubenacadie on the Intercolonial railway 74 miles by a good wagon road.

Geology.

The surface of this district is largely covered with drift, and there are so few outcrops that the structure has been determined almost w...

from underground geology. The published plan was constructed from plans and sections of the underground workings, which, while giving the general structure of the main workings, made no claim to show the structure of the series beyond them, along the cross-cuts towards the north and south. Later detailed surveys made of the cross-cuts and levels driven along the veins at depths of 134, 200, and 300 feet in the Dufferin mine show that instead of the Goldenville formation being brought up in a single anticline, as shown in the published plan, there are really two minor anticlinal flexures along the crest of the main plication.

The axes of the two folds are 245 feet apart. The northern fold is much broader than the southern, its south limb dipping south at an average angle of 45° and its north limb dipping to the north at an angle gradually increasing to 78°. At the surface the strata of the south anticline dip south at an angle of 62° and north at an angle of 77° and curve abruptly at the apex, which crops out 15 feet south of the vertical shaft. This fold plunges east and west at low angles, thus forming a long narrow dome, the centre of which lies not far west of the vertical shaft. The axial planes of the two anticlines and of the intervening syncline lie approximately parallel and dip to the south, the syncline lying 48 feet from the southern anticline. The axial plane of the southern fold dips south at an angle of 77°, being 48 feet distant from the vertical shaft in the cross-cut from the 200 foot level, and 72 feet at the 300 foot level.

The rock exposures north of the Lake Eagle vertical shaft apparently indicate a double folding corresponding to that at the Dufferin mine.

A left-hand fault probably passes through Eagle lake in a southeast direction, giving a horizontal displacement of 1,500 feet, while another which has not been exactly located, lies about 850 feet east of the Dufferin vertical shaft with a possible displacement of 50 feet.

Character of the Deposits.

The deposits occur as a series of saddle veins, lying in the planes of stratification, and the veins that have been worked are limited to the south anticline. The north anticline being broader, seems not to have afforded conditions favourable for the deposition of ore, for in the cross-cut driven to the north from the 200 foot level in the Dufferin mine only one vein, and that but 1 inch thick, was cut between the syncline and the axis of the north anticline, while in the 45 feet that this cross-cut is extended north of the axis not one vein was cut. Quartz veins, said to be auriferous, have, however, been uncovered at the surface, at a distance of 105 feet and more north of the axis.

On the south anticline mining operations have revealed the presence of a succession of saddle veins. The first discovery was made by means of pits and tunnels in the surface drift which is 10 to 15 feet deep, and it consisted of 30 to 40 inches of quartz running parallel with the strata and resembling an ordinary lode. A shaft was sunk on this lode and at a depth of about 30 feet it was found to be divided by what was at first thought to be a horse, but which later developments proved to be strata forming the apex of the anticlinal fold. The first mass of quartz proved to be a rider extending upward from the interstratified vein into the fractured strata above. This rider increased with depth to a thickness of 20 feet. The interstratified vein itself was 20 feet thick near the apex. Subsequent sinking and cross-cutting has revealed several underlying veins.

The largest and richest ore bodies are confined to the apex, especially for the first 200 feet in depth, and the synclinal trough forms the northern limit of the veins. The north lead operated by the first company was worked 120 feet in depth, to the bottom of the synclinal trough, where it ended; in the cross-cut at the 200 foot level a north-dipping vein was found to end abruptly at the syncline, while in the cross-cut at the 300 foot level an 8 inch vein was also observed to pinch out at the syncline 24 feet south of the vertical shaft. The zone of enrichment has also been found to extend only a short distance south of the anticlinal axis. In the cross-cut south at the 200 foot level quartz veins were cut as far as 129 feet south of the anti-

[1] Faribault. Geol. Sur., Can., XII, 183 A.

clinal axis or 177 feet south of the syncline, but the continuation of the cross-cut 194 feet farther revealed no more veins, while in the cross-cut run 254 feet south of the syncline on the 300 foot level, quartz veins were discovered along its whole length. At this depth the fold gets a litt broader and the zone of larger and richer veins appears to be less con fined to the crest of the fold. At the 300 foot level the crest of the souther anticline was found to be broken up into two small anticlines, while at the 400 foot level it is broken into three small anticlines, carrying severa quartz veins which are of slight extent in depth on account of the sma amplitude of the folds. At the 400 foot level the larger veins lie at a st greater distance south of the main axis than at the 300 foot level, and may be that the cross-cut driven 220 feet from the shaft does not exte far enough south to enter the zone of special enrichment. The veins a very persistent on their strike, the upper saddle having been worked length of 1,788 feet.

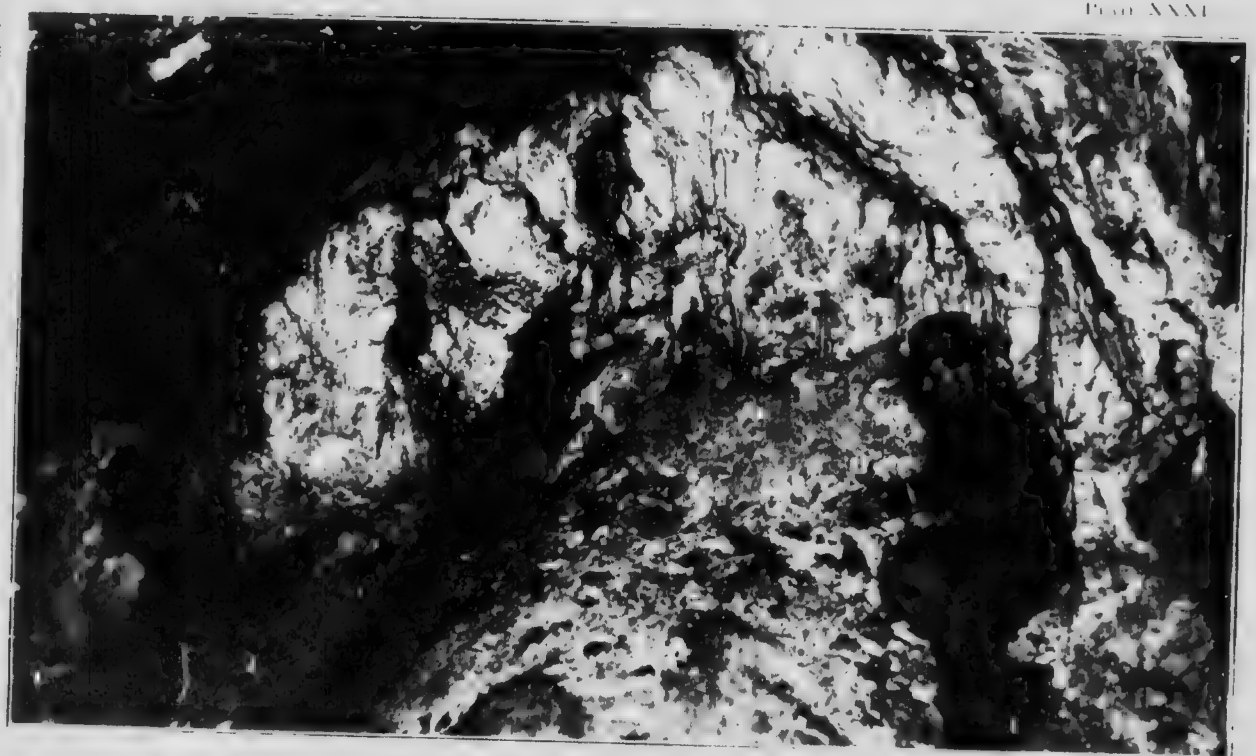
In addition to the veins at the Dufferin mine several large veins have been uncovered 3,600 feet east of the Dufferin vertical shaft near the wes shore of Eagle lake, and operations have been conducted here to a limite extent. This zone is the continuation towards the east of that of the Duf ferin, and it may be that the whole zone along the anticline between the two properties is worth exploring.

History.

A discovery of gold at Salmon river was reported in 1868, but it w not until 1880 that anything was found to merit the attention of the mine It seems that some time during this year an Indian revealed the whe abouts of some rich quartz boulders, and later search, by trenching t heavy drift, exposed a rich vein 30 to 40 inches wide. About 100 tons quartz was taken out and milled at Harrigan Cove and in sinking it wa found that the vein divided to form the legs of a saddle.

The vein was so promising that in 1881 a 20-stamp mill was erected to be driven by power drawn from the Salmon river, other necessary mine buil ings were erected, and a considerable amount of work was done on the vein, which varied from 4 to 6 feet wide on the leg. Unfortunately, the property beccame involved in litigation and after being closed for severa months was reopened some time in 1882 and the ore from the lode, whi maintained its richness and size, was crushed at the water-power m which had been increased to 30 stamps. During this year Messrs. Ro and Hattie erected an 8-stamp mill they had brought from Dung co near Isaac harbour to treat the ore from a 4 inch lead that had bee discovered near the west shore of Eagle lake.

In 1883, work at the mine commonly known as the Dufferin mine w vigorously prosecuted and twenty stamps were kept running continuall on the ore transported by tramway from the mine a half-mile distant Mr. Hattie also did some work on the Hattie lode on the west shore Eagle lake and prospected some other lodes. So energetio were the ope tions in this district that, although no considerable work was unde taken until 1881, by the end of 1883, 9,726 ounces of gold had been extract from 12,574 tons of ore. Operations were carried on steadily at the Du ferin mine for many years, the most of the ore being taken from th lode on the south limb of the anticline. In 1885 the main shaft had reached a depth of 150 feet and towards the east the vein had been found to crease in width and richness. The returns for this year were 4,924 oun but the following year was the banner year of the district, 6,509 oun being extracted from 11,628 tons of ore, an average yield of 11 pen weights, 4 grains per ton. The works were pushed eastward where t quartz measured 4 to 12 feet in thickness. Half a mile above the da from which power for crushing was obtained another dam was built, and power for pumping and hoisting was thus obtained and transmitted thre fourths of a mile by a system of pulleys and endless ropes. In 1887 w was carried on in both the east and west parts of the Dufferin mine, and t mill, which then consisted of thirty-eight stamps, was kept running c tinually. The principal work at the Dufferin mine in 1888 was to the ea ward in the saddle-back or rider where the quartz reached in plac



Dufferin mine, showing the seam on the apex of the anticline.

9869—p. 222

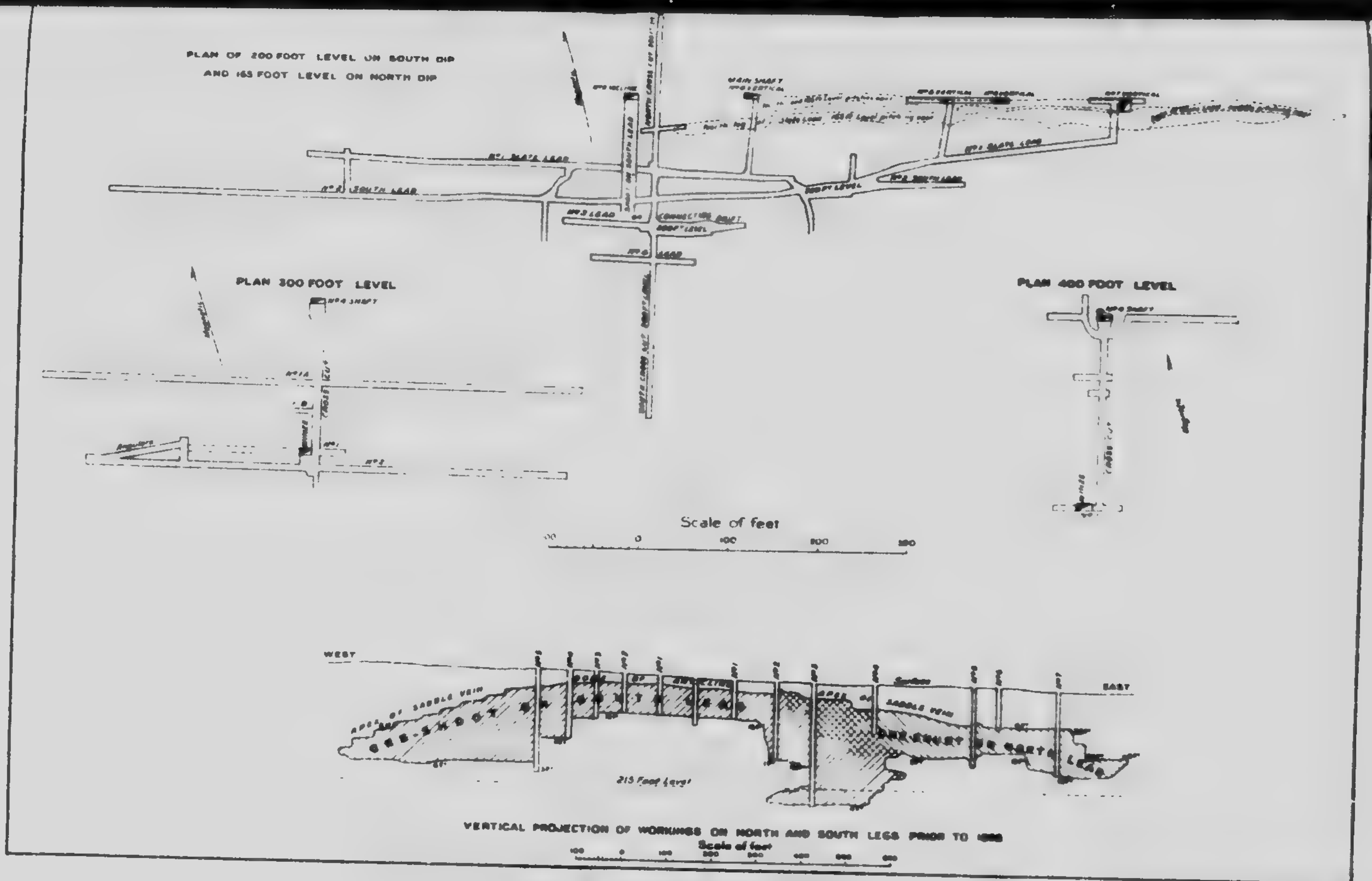
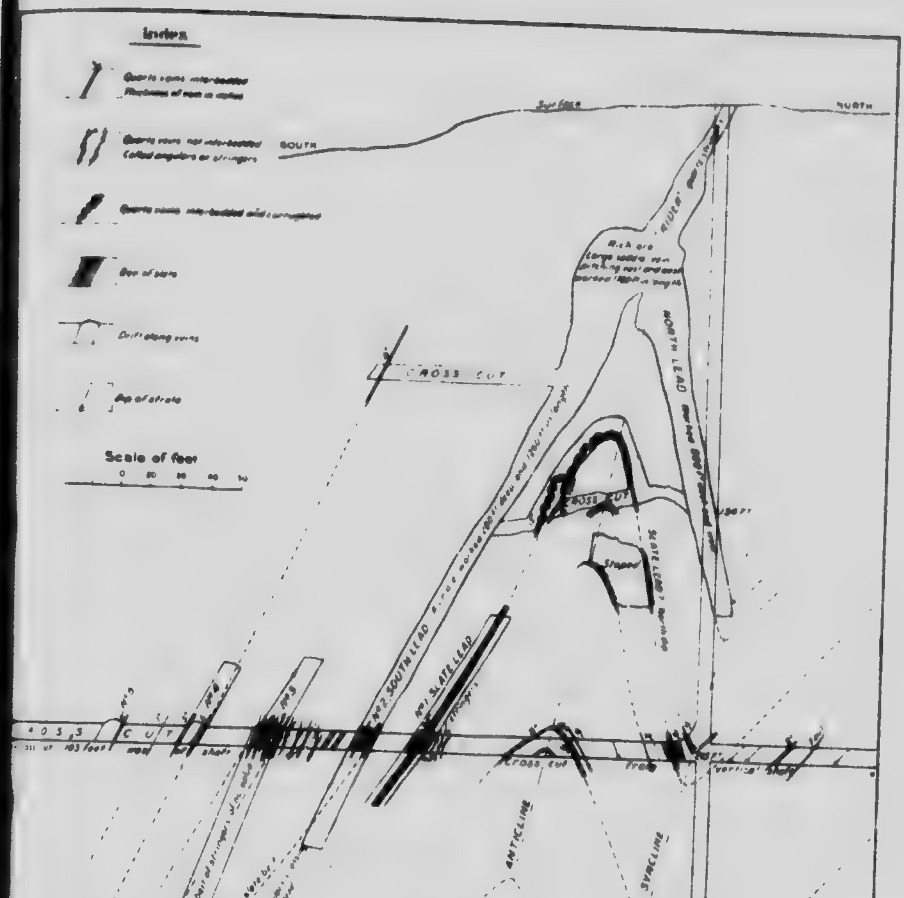


Fig. 8—DUFFERIN MINE
SALMON RIVER GOLD DISTRICT

To accompany Memoir No. 20



To accompany Memoir No. 20

Fig. 9—DUFFERIN MINE

SALMON RIVER GOLD DISTRICT

Composite cross-section through vertical shaft and cross-cut at the 200-foot Level, by E. R. Faribault, 1902

thickness of 20 feet. Pending a transfer of interests work was not energetically carried on in 1889 and the production fell to 2,032 ounces.

In 1890, there was a reorganization and the property was afterward controlled for a number of years by the Dufferin Gold Mining Company, A. K. Archibald, managing director. During this year a new 20-stamp mill was erected and 2,070 ounces of gold was extracted. The following year thirty men were employed and both the north and south leads were worked, but the ore was of lower grade than that which had been mined during the eighties, and that mined during subsequent years has also been a low grade ore. In 1892 work was conducted under the management of H. Archibald, forty men were employed, and work was carried on principally in the second east shaft. Some cross-cutting to the north was also done. In 1893, A. K. Archibald was manager and R. Irving underground manager. In 1894, the production fell off a great deal and returns were made for eight months only. Work ceased and the mine remained idle for three or four years, and no returns were made until 1899.

In 1897 the old Hattie property was worked a little and Geo. A. Irving and others reported 60 ounces from 40 tons of ore.

The Montreal-London Gold and Silver Development Company, Ltd., acquired the Dufferin mine in 1897 and an extensive and costly plant was erected. A building was completed with room for a 90-stamp mill and thirty stamps were put in. This was driven by steam power. For the treatment of the tailings three sets of hydrometric sizers and fifteen 6-foot Frue vanners were put in. Air compressors and an electric lighting plant formed a part of the extensive plant. Operations were carried on in 1898 under the management of Bernard McDonald, the old main shaft was enlarged and deepened, and a cross-cut was driven south which intersected two auriferous slate belts. The Company purposed sinking a vertical shaft to a depth of 1,000 feet and driving cross-cuts to intersect auriferous veins, from which the ore would be hoisted by the one shaft. This work was watched with keen interest by the gold miners of the Province as being of such a character as to throw light on the problem whether a system of deep mining by vertical shafts and cross-cuts could be profitably carried on. In 1898, the vertical shaft was started and carried to a depth of 200 feet. In 1899, 175 men were employed under the management of E. A. Daly, and 1,086 ounces of gold was extracted from 12,749 tons of ore. The vertical shaft was deepened to 300 feet, cross-cuts were run at intervals north and south, four parallel leads of good size were struck and work was done on some of them. At a depth of 200 feet on No. 2 lead a level was driven 500 feet, while on No. 1 or the Slate lead and on No. 3 lead levels were driven several hundred feet. At the 300 foot level No. 1 and No. 2 leads were also opened. During this year thirty more stamps and eight more Frue vanners were put in to treat the large body of ore opened up. In 1900, L. W. Getchell was manager and the vertical shaft was sunk 100 feet deeper. One hundred men were employed, levels were extended, some stoping was done, and 780 ounces were extracted from 6,600 tons of ore. In June the property was acquired by the J. Gordon Miller Mining and Milling Company and this Company returned 247 ounces from 725 tons of ore. This year the Lake Eagle mine received some attention, and under the management of W. Getchell a vertical shaft was sunk to a depth of 185 feet and there was some drifting and cross-cutting.

No returns were made in 1901, but in the summer of 1902 the Dufferin Mine Syndicate commenced testing the ore in the mine with a view to erecting a bromo-cyanide plant for treating the concentrates. Thirty stamps and twelve Frue vanners were kept running, but only 24 ounces of gold was returned from 719 tons of quartz. In 1903, a bromo-cyanide plant under the management of Mr. Maze was treating the old concentrates from the Dufferin mill and the first 44 tons treated yielded $15 per ton or 75 per cent of the gold content. Returns of 202 ounces of gold from 534 tons were made from this district in 1904. The mine was pumped out in 1905 for examination by Mr. Rickard, but was allowed to fill again.

In June, 1909, the Eagle Mining Syndicate, Munroe Archibald, manager, commenced operations on a 14 inch vein lying in a 4 foot slate belt in the western part of the district about half a mile from the main Dufferin works. This lead dips south at an angle of 53 degrees and carries arseno

pyrite. The shaft is 50 feet deep and from the bottom, levels have b driven east 54 feet and west 107 feet. From 143 tons of ore 97 ounce gold was recovered, crushing being done at the Dufferin mill.

General Development.

The great proportion of the gold produced by this district came f the first vein discovered, and the first company operated the north a south legs of this vein westward on the pitch of the fold for a length 1 211 feet and eastward 577 feet, giving a total length worked of 1,788 fee the stoped portion having an average depth of 120 feet and a maxim depth of 300 feet. Subsequently a vertical shaft was sunk 420 feet. crosscuts run at depths of 134, 200, 315, and 420 feet developed a suc sion of veins, which do not outcrop at the surface and which have b worked above the 315 foot level. At the 400 foot level very little was d

As has already been pointed out, the portion of the fold between t Dufferin and the Lake Eagle mines seems to offer a good field for the p pector. The advantages to be derived from the water-power of Sal river should serve as an incentive towards further exploration. It lieved by some who worked on the upper saddle vein at the Dufferin m that paying ore is still to be found on the east and west pitch of t saddle.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton 2,000 lbs.		
	Oz.	dwt.	gr.	Tons.	Oz.	dwt.	gr.
1883	3,885	19	19	7,602	0	10	
1884	3,397	0	0	9,799	0	6	[illegible]
1885	4,924	0	0	10,880	0	9	[illegible]
1886	6,560	0	0	11,628	0	11	4
1887	3,258	0	0	10,602	0	6	
1888	3,364	10	0	9,925	0	6	[illegible]
1889	2,032	14	0	7,633	0	5	7
1890	2,070	0	0	6,415	0	6	10
1891	1,406	0	0	5,210	0	5	[illegible]
1892	1,042	10	0	4,220	0	4	22
1893 (9 months end Sept. 30)	882	0	0	3,220	0	5	[illegible]
1894 (Year ending Sept. 30)	271	5	0	1,467	0	3	[illegible]
1899	1,086	4	2	12,749	0	1	[illegible]
1900	1,027	14	0	8,825	0	2	7
1909	97	0	0	143	0	13	[illegible]

SHERBROOKE OR GOLDENVILLE.

Location.

Sherbrooke gold district lies in Guysborough county 2 miles west of the town of Sherbrooke and close to the northwest arm of St. Mary river It is about 90 miles east of Halifax, from which city it is reached in the summer by steamer. It is also connected by daily stage with Antigonish, a town 40 miles distant on the Intercolonial railway. It is frequently spoken of as the Goldenville district from the name of the village that sprang up here on the discovery of gold.

Geology.

The Goldenville formation is exposed here, in fact this formation is so named because of its exposure in this the most important gold dist of the Province. The anticline runs approximately N. 75° W. (magnetic

[illegible] plunges to the west at angles varying from 0° at the east to 30° at the west. At the eastern end of the Bluenose property the strata are closely folded, run about parallel with the anticlinal axis, and curve sharply over the apex, quickly reaching a vertical and even an overturned dip on the south limb. Toward the west the fold becomes gradually broader, the outcrops of the strata form curves, and the vertical dip on the south limb is reached at a much greater distance from the axis. The fold is unsymmetrical and the strata on the north limb dip north at an angle of about 45°.

Although the rock structure appears at first glance a simple anticlinal fold there are very important exceptions to its uniformity. Radiating from the main anticlinal axis are several subordinate gentle undulations which play an important part in the ore deposition. "Three well-defined transverse undulations have been traced on the north side of the saddle, the most easterly of which leaves the main Cobourg shaft near the anticline and runs N. 65 W. (magnetic) to the shafts on the Gold Hill belt, then curving slightly to the north, it runs N. 57 W. (magnetic)." The second undulation leaves the Mayflower belt on the anticline, and runs N. 50° W. (magnetic) to and beyond the Hayden lead, while the third passes about the McCrae vein.

In the east end of the district there are several small cross-faults, the two largest giving a horizontal displacement of 40 and 42 feet on the south side of the fold.

Character of the Deposits.

The veins that have been worked all lie in the stratification planes, generally in belts of slate with walls of quartzite. Among those that have proved most productive are the following: Cobourg, Bunk, Wellington, Dewar, Blue, Zwickel or Jumbo, Little Hayden, McClure, and Harrison on the north; McNaughton, not outcropping, but discovered by cross-cutting; Springfield, Wentworth, North, Canada, Lriker, Mayflower, Palmerston, and Meridian on the south. The size of these and of a great many other veins is given on the published plan. In some of the wide belts, as the Palmerston and Meridian much of the slate lying between the quartz veins is more or less auriferous and a great proportion of the belt has been worked as a low grade deposit either by open cut or underground mining.

This district illustrates well the intimate relation existing between rock structure and the position and richness of the ore deposits. On the north side the enlargements of the veins and the pay-shoots are found to occur along well-defined lines corresponding with the lines of [illegible] [illegible] undulations radiating from the axis of the anticline, while be[illegible] [illegible]n these undulations the veins become impoverished, narrow, [illegible] pinch out altogether. Along the line of the most easterly of the undulations, which leaves the Cobourg shaft and runs to the shafts on the Gold Hill belt and then curves to the north running to the Gladstone, [illegible] a series of rich streaks. The depths to which some of these streaks had been worked on the incline in 1897 are as follows: Cobourg, 2[illegible] feet; Gold Hill, 75 feet; Bung, 280 feet; Wellington, 750 feet; Dewar, [illegible] [illegible] Whin, 100 feet; Blue, 300 feet; McKenzie, 150 feet; Zwick[illegible] Big, [illegible] feet; Gladstone, 140 feet; McClure, 300 feet; Harrison, 300 [illegible]; [illegible] Cameron, 60 feet; Dan McKenzie, 90 feet; and Wheel, 75 feet. On the second undulation, which runs N. 50° W. (magnetic) from the Mayflower belt, pay-shoots have been worked on the following leads to the depths indicated: Mayflower, Root Hog, and John R., 90 feet; M[illegible] Sargent, and Bailey, 130 feet; Old Hayden, 90 feet; Jumbo, 180 feet; and Little Hayden, 350 feet. Only a few veins have been opened on the [illegible] undulation passing about the McCrae vein.

On the south side of the main anticline the line of pay-shoots runs nearly parallel with the axis, receding from it at the west. Each vein [illegible] richest in that part where it has a straight course and nearly vertical dip, [illegible] just near where it begins to curve towards the axis.

Faribault, Geol. Sur., Can., N. 10[illegible] A

[illegible] 15

neral the shoots dip to the west with the plunge of the anticl
like those in the Wellington, Dewar, and Blue were espe
ned. These dipped west 35°.
he south side of the fold a line of pay-shoots runs S. 35° E.
from the Mayflower belt and includes the rich streaks worked
the big Palmerston and Meridan belts to a depth of 100 feet.

Developments at the Bluenose mine in the eastern part of the dist
show that underlying the veins exposed on the surface is a series of sa
veins which fold over the apex of the anticline and extend down
limb. These attain a large size on the apex, decrease until they assume
vertical attitude, and then so far as present developments show they dim
ish but little in size with depth. This underground work reveals a
subordinate flexure on the north limb. Most of the veins inters
have proved, auriferous and three of them, the McNaughton and
Dunstan on the south dip and the Cantley on the north dip, were w
The McNaughton belt has been shown by underground workings to
from 6 feet thick on the 460 foot level to 5 feet 10 inches, where it b
to curve over the apex of the fold. It is composed of large irr
quartz rolls and stringers pitching west 15° to 22° in slate interb
with a few thin layers of quartzite.

History.

This district may without doubt be regarded as the most impo
district of the Province, its total production having greatly exceeded
of any other. One of the earliest discovered, it rose almost immedia
to the rank of an important producer and for twenty years continue
make large returns, several years exceeding 7,000 ounces, and one
1867, reaching the high-water mark of 9,463 ounces. The district p
through a period of comparative quiescence during the eighties and
nineties, after which it again became the scene of renewed mining
ity and rose to the first rank among the producing districts.

The discovery of gold in this district is described by the Chief
Commissioner for 1862, as follows:

'In the summer of 1861, Nelson Nickerson of Sherbrooke, having
a visit to Tangier gained the information necessary to enable h
distinguish quartz from other rocks, returned home, and, while e
in making hay in a small meadow about a mile and a half west
northwest arm of St. Mary river, noticed the quartz rocks
over the land in different places, that had become exposed to view
action of extensive fires which had raged through the forests at d
times within the previous twenty years. By examining and breaking
he found gold, and was so much encouraged by the quantity thus
that it became the principal business of himself and family for so
which, however, they managed to keep secret.

'About the first of October his neighbours began to suspect that
obtaining the precious metal somewhere in the forest. He and
were closely watched, in their movements, from that time, unt
fifteenth of the month, when he was discovered by the sound of his
On the 18th of October, 1861, when this fact became generally kn
two hundred assembled on the ground who on that day, as is
supposed, obtained gold by breaking quartz, to the amount of $100

A surveyor was sent in, areas were laid off, prospecting was
carried on, and soon the district was a live and energetic minin
1862, over 2,000 ounces were produced and the following tabl
principal veins mined that year, the depth to which each was
the maximum and average yield per ton.

Lead.	Depth.	Maximum yield per ton	Average yield per ton
Cumminger			
Aikens	20 ft.	[illegible]	
Hayden	30	[illegible]	1 oz.
Drysdale	30	[illegible]	1
McKay	30	[illegible]	3
Blue	32	[illegible]	2
Hewitt	40	[illegible]	1
	60	12	1
			4

The years, 1863, 1864, and 1865 saw an increased production, but a decrease in the yield per ton. This was due to the crushing of a certain amount of alluvium and portions of the slate belts adjacent to the veins, so that although the yield per ton crushed was not so great the average yield per man employed was considerably greater. In 1866, the mines were worked with still greater profit and with increased activity. The Cumminger lode, which dipped north 45° and is probably the one indicated on the plan as the Wellington lode, was worked by Messrs. Cumminger & Co., who sank three shafts, the most easterly 87 feet deep, the middle 122 feet, and the westerly 200 feet. Much of the lode between these shafts was stoped. On the adjoining area to the north the New York and Sherbrooke Company started a shaft with the intention of cutting the Cumminger lead at a depth of 200 feet; while the Wellington Company sank two shafts on this lead to the west of the Cumminger mine, the eastern one being 200 feet deep and the western 71 feet deep. On the Blue lode, about 500 feet north of the Cumminger, the Grape Vine Company had a shaft 278 feet deep and stoping was carried on at the 150 foot level on the east and below the 213 foot level on the west. A 2 inch lode lying south of the Blue lode was worked by Messrs. Bayne and Hayden and by the New York and Sherbrooke Company. Two shafts were also sunk on the Palmerston lode by Messrs. McClure and Company, and one by Messrs. Cumminger & Co. The lode was found to consist really of two lodes 3 and 4 inches thick with over 3 feet of intervening slate.

In 1867, the district made its highest production—9,463 ounces. Work was brisk. The Palmerston lodes were worked by the Dominion Company, the Metropolitan Company, and Messrs. McClure and Company. Two shafts were also sunk by the Dominion Company on the Hewitt lode. The Wellington Company continued sinking on the Cumminger lode and stoping [illegible]. Messrs. Hayden and Derby still worked the lode south of the Blue lode. The New York and Sherbrooke Company sank two shafts on a lode [illegible] feet north of the old Hayden lode, and farther west on the same lode [illegible] shaft was sunk by Messrs. Hayden and Derby.

In 1868 five new crushers were erected and [illegible] of the mines [illegible] was steadily pursued. The Wellington Company's [illegible] shaft on the Cumminger lode was 280 feet deep and from it stoping was carried [illegible] feet [illegible] east and 100 feet to the west. This Company also had two shafts on the Beaver lead, about 100 feet to the north. Work was continued on the Hayden and Derby lode and ore was hoisted by a 110 foot shaft. The New York and Sherbrooke Company being unable to cope with the water entering [illegible] mine suspended operations in October. South of this Company's [illegible] property a lode showing 18 inches of quartz along with 18 inches of slate was opened by the Delta Company. This lode shows a bend in the strike [illegible] rock and dips westerly. On the adjoining property the Crescent Company [illegible] opened three shafts. The principal operations of the Dominion Company were confined to the Palmerston belt from which a body of ore 20 feet wide and 80 feet long was removed by underhand stoping. The same Company worked the Hewitt lode also for a short time during the early part of the year. The Palmerston belt was also worked during the

greater part of the year by the Palmerston Company, who sank shafts on a lode lying to the north of the Palmerston. The Metropolitan Company did a limited amount of work on the Palmerston belt, but its chief operations consisted of the sinking of two shafts, one on the Hewitt lode and one on the Archibald lode about 20 feet south of the Palmerston. A cross-cut was also driven from the Hewitt to the Palmerston. The Kingston and Sherbrooke Company sank a 35 foot shaft on the Cumminger lode about 600 feet east of the Wellington Company's No. 1 shaft, one on the Dewar lode and a shaft on each of two lodes considerably to the south of this part of their property. Still farther south five shafts were sunk on different lodes by the Meridian Company. One 60 feet deep was sunk on the Sears lode on which levels were driven, one on a lode 50 feet to the south containing three veins of quartz in a thickness of 3½ feet, one on a 2 inch lode 80 feet farther south, and one 120 feet still farther south on a lode containing three veins of quartz. Adjoining the property of the Meridian Company on the east was that of the Chicago Company by whom six shafts were started; to the east also lay the property of the Canada Company by whom a 50 foot shaft was sunk on the Dr. Hea lead. Shafts were also sunk by this Company on lodes to the south of this. The Wentworth Company sank two shafts on the Ferguson lode, one on a 22 inch lode to the north and another on a lode 70 feet south. On the adjoining property to the north a 60 foot shaft was sunk by the Cobourg Company on a 12 inch lode. The properties of the Caledonia Company and the Woodbine Company lay still farther east and the former Company sank on a lade 28to 35 inches wide, while the latter opened the Woodbine lode by three shafts. All the companies in the eastern part of the district started operations this year, and of these the Meridian, the Wentworth, and the Canada all erected 15-stamp mills.

In 1869, there were nineteen companies operating in this district. At most of the older workings mining was actively pursued, but some of the properties which were opened for the first time, 1868, did not receive a great deal of attention. The Wellington Company deepened its west shaft on the Cumminger lode to 330 feet and its shafts on the Dewar lode to 75 feet. Some work was done by this Company on the Hayden and Derby lode, while from a lode 4 feet north of the Hayden lode a cross-cut was driven 150 feet to the north. On the property adjoining that of the Wellington Company two 90 foot shafts were sunk on the Dewar lode by the Rockville Company. The work of the New York and Sherbrooke Company was chiefly of an exploratory character and several new lodes were exposed. The operations of the Delta Company were discontinued after the shaft had been deepened somewhat, and some cross-cutting and a little stoping had been done. Similar work was done by the Crescent Company, but after February work was almost suspended. The Stanley Company opened some lodes, three of which dipped slightly to the south and one to the north, but work on these also was suspended. The Palmerston belt received a large measure of attention and a large amount of ore was stoped out by the Dominion Company, the Palmerston Company, and the Metropolitan Company. The last-named Company did considerable stoping on the Archibald lead and from the Hewitt lead drove a cross-cut 80 feet south. On the Kingston and Sherbrooke Company's property nothing was done except deepening of the two shafts to about 75 feet. The work of the Meridian Company was confined to the Striker lode, which was cut in a cross-cut from the Sears lode. The Chicago Company did some stoping on the Sears lode, drove a cross-cut south 60 feet and north 65 feet, and in a vein cut 24 feet to the north, drove levels and stoped out a block of ore. The same Company opened the Ferguson lode about 150 feet farther north. The operations of the Canada Company were also limited. There was some sinking and stoping on the Milroy lode together with a little cross-cutting and some sinking on a large lode 200 feet south of the Dr. Hea lode. Work was carried on by the Wentworth Company on the Cartwright lode, the Ferguson lode, and a lode farther south. The Cobourg Company extended its shaft to a depth of 130 feet. The Woodbine Company hoisted ore from the Woodbine lead by three shafts, 76, 45, and 31 feet deep, while on the Blakie lead 15 feet to the north of the Woodbine two shafts were operated. The Caledonia Company sank on the Blakie lead and drove

75 feet south without cutting any lead of importance. To the southeast of these operations a 12 inch lode was discovered by Mr. McKinnon, some open-cutting was done, and a shaft was sunk.

In 1870 over 7,000 ounces of gold was returned and of this over 6,000 ounces were produced by four companies, the Wellington, Dominion, New York and Sherbrooke, and Palmerston Companies. The Wellington Company continued to mine the Cumminger and Dewar lodes. On the former the main shaft was carried to a depth of 400 feet and the length of the stoping was 220 feet, 60 feet of which extended east of the shaft. On the Dewar lode the stoping ground was 200 feet long and the shaft 110 feet deep. This Company recovered this year 2,162 ounces of gold from 2,698 tons of ore. The New York and Sherbrooke Company continued to mine the lodes opened in 1869 and other lodes in the vicinity, and several shafts were sunk. On the adjoining property to the east Mr. McDaniel opened several veins. A shaft was sunk 120 feet deep on the Harrison lead, one 120 feet deep on a lode 30 feet to the north of the Harrison lode, and one on another lode 30 feet farther north. A shaft 110 feet deep was also sunk on the Sutherland lode about 500 feet south of the Harrison lode, and west of the shaft this lode was found to turn abruptly to the south and unite with an aggregation of irregular quartz masses. The principal operations on the Palmerston belt were those of the Dominion Company. Stoping was conducted on this belt and on an 8 foot belt opened by a cross-cut 18 feet to the north. The Palmerston Company sank a shaft 110 feet to test the Palmerston lode below the known pay-shoot, but little gold was found. A lode 14 feet to the north of the Palmerston was opened by cross-cut and mined considerably, while two shafts were sunk on a lode 70 feet north of the Palmerston. East of this point Mr. Cleverdon worked the Sears and Striker lodes, but many of the properties were closed or had changed hands. The Ferguson lode, which had been opened by the Wentworth Company, was mined by the Hamilton Company. The same lode was worked on the Caledonia Company's property by Mr. Twist, and the Chicago Company worked a lode lying to the north of the Sears.

In 1871, five mines were worked the year around, the Wellington, the New York and Sherbrooke, the Dominion, the Palmerston, and a small mine worked by Messrs. McClure and Snow; while in August and September as many as eighteen mines were worked. The principal returns were made by six companies as follows:—

	crushed.	Gold recovered.
Wellington		
Sherbrooke	[illegible] tons	1,385 ozs
Dominion	1,698 "	1,696 "
Palmerston	2,580 "	637 "
Caledonia	4,048 "	805 "
Wentworth	367 "	502 "
	2,542 "	736

The Wellington Company's workings on the Cumminger lode were extended to a depth of 480 feet and on the Dewar to 170 feet. The New York and Sherbrooke Company worked for a while on the McDaniel and Sutherland lodes, but its principal operations were on the north lode, where the shaft was deepened to 200 feet, and the Harrison lode, where the shaft was deepened to 210 feet. The Palmerston [illegible]pany worked the same lodes as in 1870, continuing the shaft on the [illegible]erston lode to a depth of 120 feet. Shafts were also sunk on the Striker lode and levels driven, while two shafts were started on the Snow lode 100 feet north of the Striker. The Dominion Company worked the Palmerston, but suspended operations at the end of the year. The Caledonia Company discontinued work on the Ferguson lode, but opened the Caledonia or Wilson lode about 20 feet north of the former. The Meridian Company resumed operations on the Striker lode and shafts were sunk 120 and 115 feet.

The Hamilton Company continued to work the Ferguson lode removir the ore by overhand stoping; they also made an open-cut 160 feet long a 32 feet deep on the Caledonia or Wilson lode. The cross-cut from the w shaft of the Ferguson lode was extended north to a length of 120 f There was some prospecting during the year and James McDonald ma an open-cut 150 feet long and 23 feet deep on a lode discovered north the Wellington.

In 1872 there was quite a little tributing and the production fell 4,188 ounces, although much richer ore was crushed. The mining whi had been carried on continuously for a number of years on the Welling ton lead was discontinued in August when the shaft had reached a dep of 500 feet and it was found that the machinery on the ground was sufficient to carry on mining profitably at a greater depth. The Dewar le on both the Wellington and Rockville properties was worked by tribute and the same lead farther east on the Rochester and Try Again pr perties was reopened by tributers after several years of idleness. T McLean or Little lead on the Wellington and Alexander properties a the Archibald lead on the latter property were also reopened by tr buters after lying idle for several years. The Palmerston Company ceas work and let its property to tributers, who sank two shafts 40 feet d on a 14 inch lead which they had discovered 18 feet south of the Snow l The Meridian Company, after working the Striker lead for the grea part of the year, turned their attention to prospecting for the new lead found on the Palmerston property, and search was also made for it by British Company on the Cleverdon property. Operations ceased the property of the Caledonia Company, and the Hamilton Company suspended operations after sinking on a small abandoned lead 150 north of the Ferguson lead and finding it too small to be worked profit. The New York and Sherbrooke property was worked on trib by Israel West, who employed on an average twenty-one men on the Ha rison or South lead, on which he deepened the main shaft to 250 feet. H also prospected the Hayden and Derby property and in September covered a promising lead.

There was an increase in production in 1873 and the principal work were on the Dewar lode on areas 651 and 652. On the New York Sherbrooke property work was discontinued in August, but on the Hay and Derby property adjoining it on the south Mr. West continued op tions on the lead opened in 1872, carrying stopes 150 feet long to a d of 90 feet. The new lead discovered on area 747 on the Palmerston pro in 1872 was mined, [illegible] extension on areas 749 and 750 was also wo Some tributing was also done on the Striker lead and on the Canada Caledonia properties.

The year 1874 was rather dull. Mr. West ceased work on the lead the Hayden and Derby property, and work on the Dewar lode on the T Again property and for a time on the Rochester property also ceas The Dewar on areas 620, 621, 622, and 623, block 3, however, contin to be mined. The tributers working on the Palmerston property mined the extension of the South lead of the Dominion property. A 748 and 749, block 3, were profitably worked and mining was carried on the extension of the same belt on areas 750 and 751 on what was th to be the Striker lead. This year some new leads were discovered a tested and some old ones reopened. Mr. Zwickel did some work areas 674 and 615, block 5. New machinery was erected on the Welling lead, and the 500 foot shaft, the deepest shaft in the Province at that was pumped out.

The year 1875 saw a marked revival of industry in this district due to the reopening of the Wellington mine. The production was 5,818 ounces from 6,443 tons and of this over 3,000 ounces were taken by the Wellington Company from areas 620, 621, and 622, block 3. The main shaft on the Wellington lead was opened and as the pay-shoot lay to the west of the shaft and pitched in that direction it was got at by means of an in[illegible]. The Dewar lode on which the western shaft was 356 feet deep [illegible] worked, and as the workings, extending 400 feet to the east, were drained the Rockville property adjoining on the east was also drained and was consequently reopened. Mr. Zwickel made use of the old machinery on

the Grapevine property to open a lead that he called the McClure lead on areas 614 and 615, block 3, and another small lead 40 feet to the south of t. The South lead on the Dominion property was worked until August, and on the Palmerston property until the end of the year. The same lead was also worked on the Meridian property to a depth of 120 feet, and 140 feet along the lead. Mr. Cleverdon did some work on the Striker lead on the property of the British Company and tributers did some work on the Sears lead, besides taking out the upper parts of the leads on the Chicago property.

In 1876, the Wellington was still the principal mine and stoping was carried on by both the overhand and underhand systems. The lead averaged 18 inches but in places swelled to a thickness of 24 inches. Work on the Dewar lead was also carried on and it continued to exhibit its alternately rich and poor horizontal streaks with marked regularity. On the Grapevine property, Mr. Zwickel continued working the McClure lead to a depth of 130 feet, when it was abandoned as unprofitable being only 1 inches thick and decreasing in yield from 4 ounces to 7 pennyweights a ton. The Middle lead 40 feet to the south was also abandoned and one 10 feet farther south was opened and christened the Big lead. This gave good returns and was also opened on areas 616 and 617. On the Alexander property a vein supposed to be the Murray and in line with the Dewar was opened by Mr. McEachren. Work on a small scale was conducted on the Palmerston and Dominion properties and on the Stryker lead and the one immediately to the north on the Chicago property.

The year 1877 was second only to 1867 in production, and 8,237 ounces of gold was recovered from 8,654 tons of ore. Regular work was conducted on the Wellington and Dewar lodes and another lode half way between the two was opened and yielded over one ounce per ton. The shaft on the Dewar was deepened to 120 feet and stoping on the Wellington was carried 300 feet west of the shaft. The Murray lead on the Alexander property was abandoned and the tributers who reopened the Dewar on the Try Again property found it too small to be worked with profit, for although it yielded $1\frac{1}{2}$ ounces it was only $\frac{1}{2}$ inch thick. On the Grapevine property the south lead was worked, but at a depth of 110 feet it was only 8 inches thick, whereas at the surface it was 20 inches. The Middle lead received some attention and was also mined on areas 616 and 617. Some little work was done on a lead discovered on area 631, block 4, which promised well, but was unprofitable on area 661, block 3. The discovery of some rich ore by Mr. Fraser on area 778 of the Dominion property led to renewed activity in this quarter of the district, but some of the operators did not meet with the success they had expected.

In 1878, the Wellington mine was again closed after stopes had been extended west of the shaft 300 feet and 180 feet below the bottom of the 500 foot shaft. The Dewar, however, continued a producer and its shaft was deepened to 480 feet, while the Middle lead also gave satisfactory results. This year the Blue lead, on which a 300 foot shaft had previously been sunk, was reopened. The Middle lead on area 614 was mined by Mr. Zwickel and its extension by the Gladstone Company. The Harrison lead on the Hayden and Derby property was reopened, and in the southern part of the district small blocks of ore were taken out on tribute.

In 1879, work was continued on the Dewar and Middle lodes and on a new lode 45 feet south of the old Wellington. A big lode on the Wentworth property was worked by Mr. Hattie and on the Caledonia property by Mr. McNab. Messrs. Bent and Fraser stoped some good ore from the Dominion property, and tribute work was done on the Hayden and Derby, Gladstone, Chicago, New York, and other properties.

In 1880, work on the Dewar lead was progressing and the shaft was said to be 550 feet deep. A shaft was also sunk 100 feet on the Murray lode north of the Dewar. Work ceased on the Grapevine property in May, but on the Dominion property, Messrs. Bent and Fraser continued on the lode they were working the preceding year. The New York, Hayden and Derby, Rochester, and Kingston properties received considerable attention.

The production of 1881 was much lower than that of the preceding year. The Dewar was still worked to the west of the shaft and there was talk of reopening the Wellington. The large belt on the Palmerston prop-

erty was reopened by Mr. Fraser with the intention of milling a gr
quantity of low-grade ore. Messrs. Hattie and McNab continued at w
on the leads they were mining the preceding year and John Williams d
some work on the Gladstone property.

In 1882, some new lodes were tested on the Wellington property, a
tributers worked on the Hayden and Derby property. On the Palme
ton property the wide low-grade belt was mined, a tramway was c
structed from the mine to the mill, and a consolidation of the Palmerst
and several adjoining properties was effected under the name of the Pac
lus Gold Mining Company.

This Company was the principal operator in 1883, and the belt w
extensively mined. On the Hayden and Derby property, on the R
ville, as well as on the Cleverdon and other properties, operations w
carried on. On the Meridian property, Mr. Hamilton mined a 7 foot
from which in 1882, 3,300 tons of ore had given an average yield
pennyweights 3 grains.

In 1884, the Pactolus Gold Mining Company allowed the large belt
fill with water, but worked a small lead on the Rockville property. T
extension of this lead on the Gold Hill property was worked by D. I
Cameron. One of the best paid operators was Mr. Williams, who work
the Hayden and Derby and the New York properties. Some work
done on the Alexandria and the Dominion areas and on the Caledo
areas by Messrs. McNab and Sinclair. A new lode opened on the W
lington property north of the Dewar did not come up to expectations.

In 1885, the production fell to less than half that of the preced
year. Some work was done on the New York and Sherbrooke areas b
Mr. Williams, on the Meridian areas by G. May, and on the Caled
and Alexandria areas by Messrs. Brown, McNab, and others. On
Pactolus areas the ground was tested to the west of the open-cut, and M
Cameron opened a small lead north of the Wellington. The follow
year, Mr. Williams was still at work on the New York and Sherbr
areas; several leads on the Wellington areas were tested; the Pact
open-cut received some attention, and other properties in the district
worked more or less.

In 1887, the production fell to less than 600 ounces. J. Williams &
Co. worked on the Palmerston, New York, and Hayden properties, and
work of a limited nature was done on the properties of the Dominion and
Canada Companies. Among those who were engaged in operations may be
mentioned Messrs. McLean, Fraser, McKay, Purcell, Jack, and McDonald

For a number of years mining in this district was not very brisk and
returns were small. In 1888 and 1889, James H. McDonald crushed a lo
of low-grade ore from the Mayflower belt and areas adjoining it on the
north, while during the latter year Mr. Williams made preparations to
mine low-grade ore on a property adjoining the Palmerston, and Robert
McNaughton met with encouragement in developing a property in the
eastern end of the district. In spite of these preparations the returns
for 1890 to 1893, inclusive, were very small.

In 1894, there was a renewal of interest in this district which led to a
very marked increase in the production for a number of years. So
tributing was done, but the principal returns were made by the Stellar
ton Gold Mining Co., Ltd., which was incorporated this year. Under the
management of John McQuarrie, the old Wentworth property was re
opened. In addition to this, work was started by the Springfield Gold
Mining Company under the management of R. McNaughton and prospects
were very promising.

Three companies were at work during portions of the year 1895 the
Springfield Gold Mining Co., A. J. McNaughton, manager; the Stellarton
Gold Mining Co., Ltd., John McQuarrie, manager; and the New Glasgow
Gold Mining Co., Ltd., J. A. Fraser, manager. By the first of these
twenty men were employed on the Springfield and North belts; by the
second, the Wentworth and another 9 inch lead were worked; and by the
last, the Sears, Striker, Canada, and North leads were reopened.

In 1896, the returns made by the Stellarton Company were small, but
mining was brisk on the New Glasgow Company's property. Here forty
five men were employed, and ore was stoped from the lodes reopened the
preceding year, and crushed at a 10-stamp mill. During this year th

Old dump on the Wellington and Dewar workings, Goldenville.

New Glasgow Gold Mining Company's plant, Goldenville.

Blue Nose Gold Mining Co., Ltd., was incorporated to take over and mine the Springfield, Caledonia, Woodbine, and Cobourg properties. Under the management of A. G. McNaughton, work was pushed, thirty two men were employed, a new 20-stamp mill was erected, two leads on the Springfield property were worked, and work was started on the Caledonia and Cobourg properties.

In 1897, the Blue Nose Company under the management of A. G. McNaughton had sixty men employed and a large quantity of ore was taken from the Springfield belt, the South belt, and the Cobourg lead. The New Glasgow Company had forty-five men employed and mined the North and Canada leads. George Hirschfield had twenty men at work on the North lead and made good returns. Work was started this year by the Sutherland Development Company under the management of George Brackett. A new 10-stamp mill was erected and shafts were started on the 8 inch State lead and on the Murray lead. Other leads which had been opened on the property were the 8 inch Brazen Serpent and the John R. belt with 3½ feet of crushing ore.

In 1898, the Blue Nose property made much the largest returns. Ore was hoisted from the South belt by means of a 200 foot shaft and from the Springfield belt by a 250 foot shaft. Work was conducted under the same management on the Striker and Canada leads on the New Glasgow property, and on the former the shaft was sunk to a depth of 165 feet and on the latter two shafts were sunk nearly 200 feet. George Hirschfield had twenty-five men employed for the Palmerston Gold Mining Co., on the Palmerston lead, and the Sutherland Development Co. mined the Brazen Serpent lead.

In 1899, the Blue Nose Gold Mining Company continued active operations on the two belts and returned 3,080 ounces of gold from 8,957 tons of ore. The New Glasgow Gold Mining Company conducted operations on the Striker and Canada leads under the management of G. A. Hirschfield. A test lot was also taken from the little Palmerston shaft and the Meridian lead was opened. In this year the Royal Oak Mining Co., Ltd., was incorporated, and under the management of W. J. McIntosh the shaft on the Gladstone property was pumped out and preparations were made for erecting a new 10-stamp mill.

In 1900, the Blue Nose Company had sixty men employed under the management of A. G. McNaughton, and recovered 4,568 ounces of gold from 14,316 tons of ore. The main shaft was 400 feet deep and cross-cuts were driven north from 20 to 150 feet long in which a number of veins were intersected. Ten more stamps were added to the mill and a Wilfley concentrator was put in. At the Royal Oak mine, the shaft on the Zwickel Big lead was found to be 200 feet deep and it was extended 200 feet deeper. A cross-cut was driven south, which cut the McKenzie lead and one to the north also to get the Gladstone lead. The Stuart-Hardman and New Glasgow properties were taken over by the Union Development Company and development work was started under the management of N. Nopping. Ten stamps were added to the New Glasgow mill; the old Wellington shaft was unwatered [illegible] 00 feet; and a large two compartment vertical shaft was started ne[illegible] west end of the Palmerston property. Work was suspended, however, in February owing to litigation.

In 1901, mining was continued at the Blue Nose, and a large quantity of low-grade ore was treated, so that the great proportion of the gold reported from this district was from this mine. At the Royal Oak mine the cross-cut to the north was driven far enough to intersect the Gladstone and McClure leads, some overhand stoping was done on the Zwickel Big lead, but the principal work was done on the Gladstone lead about 700 feet farther west. Some tributing was done this year on the Meridian lead.

During 1902, little work was done at the Blue Nose mine on the Springfield belt and operations were almost wholly confined to belts that were opened up by cross-cuts driven to the north at the 280 and 360 foot levels. Three of these belts not outcropping at the surface were named the Cantley, the Fraser, and the McNaughton. The last one was the most important and operations on it were quite extensive. This year the Royal Oak mine rose to the rank of an important producer, and some sixty men were employed. The deep shaft on the Big lead was abandoned and active oper

ations were conducted farther east. The shaft on the Jumbo lead was deepened to 215 feet, levels were driven, a cross-cut was driven north to the Little Hayden lead; and on the Hayden belt to the south a shaft was started to meet a raise from the end of a cross-cut from the Jumbo workings. Some ore was removed also from this south Hayden lead. Preparations were made to put in ten more stamps, thus making the mill a 20-stamp mill.

Extensive operations were carried on in 1903 at the Blue Nose and the Royal Oak mines. The main shaft on the Springfield belt was deepened to 470 feet and another cross-cut was driven north to the McNaughton belt on which new levels were driven, the old ones extended, and a great deal of stoping done. The old Wentworth workings were also reopened by the Blue Nose Company who purposed sinking and driving east under the old workings to strike a rich roll pitching west from its outcrop at the east. Work was continued on the Jumbo lead by the Royal Oak Company under the management of W. J. McIntosh. The shaft was deepened to 320 feet, blocks of ore were stoped, and cross-cuts were driven to the Hayden lead from which a considerable quantity of ore was taken. Exploratory work was also prosecuted on the McKenzie lead and another belt to the north. This year, Geo. W. Stuart continued the vertical shaft, 11½ feet by 4½ feet, to exploit the ground west of area 713, the intention being to cross-cut south at the 160 foot level and work the Palmerston and other belts. At the time of the inspector's visit the shaft was 123 feet deep and operations were in progress.

The production for 1904 was much less than half that of 1903. Work was continued at the Royal Oak mine, but the returns were small. Some work was done on the Jumbo and Hayden leads and on the Gladstone lead where the old 420 foot shaft was pumped out and repaired. The old Zwicker shaft 300 feet east on the same lead was also pumped out. The Blue Nose mine produced 431 ounces of gold from 3,200 tons of ore, but it was not worked continuously and was closed some time during the year. Development work was continued by the Nova Scotia and Mexican Mining Co.—Geo. J. Troop, manager—and the vertical shaft sunk the preceding year by Geo. W. Stuart was continued to a depth of 260 feet. At the 160 foot level a cross-cut was driven north 206 feet and south 307 feet. At 70 feet north of the shaft a small lead supposed to be the North Palmerston was driven on for a short distance. Other veins were cut to the north at 98 feet, 115 feet, and 146 feet from the shaft and on the last which was thought to be the Mayflower belt, levels were driven 225 feet east and 97 feet west. In the cross-cut to the south the Tributer vein was struck at 54 feet, the Stuart belt, 19 feet wide, at 72 feet, and the Hard belt at 97 feet. Some little work was done on the Tributer vein, and the whole width of the Stuart belt was opened 48 feet east and 28 feet west. At the 260 foot level a second cross-cut was driven 110 feet south. A stamp mill was erected and over 1,000 tons of ore crushed yielding [illegible] ounces of gold.

The mine of this Company was full of water at the time of the inspector's visit in 1905, although for this year returns of 427 ounces of gold from 2,665 tons of ore were made. During the winter the Company had constructed a plant for developing water power at Liscomb Falls, had cut out a line and put up poles for electric transmission of power to Goldenville, a distance of 7 miles. The Royal Oak Mining Company under the management of Col. Evans continued work on the Zwickel Big lead to a depth of 400 feet. On the 400 foot level a cross-cut was driven south [illegible] feet to the Blue lead, cutting the McKenzie belt at 33 feet south of the Zwickel. A level was driven east on the Blue lead in which the pay-shoot was struck and was stoped. This Company recovered 222 ounces of gold from 283 tons of ore in 1906, but since then no returns have been made except a small amount in 1909 by Geo. A. Hirschfield who crushed 61 tons of ore, yielding 22 ounces, from a small lead on the Neilly property on or about area 720.

General Development.

The depth to which the different veins were worked is indicated on the published plan of the district for which the survey was made in 1897, and apart from this we have very little definite information regarding the

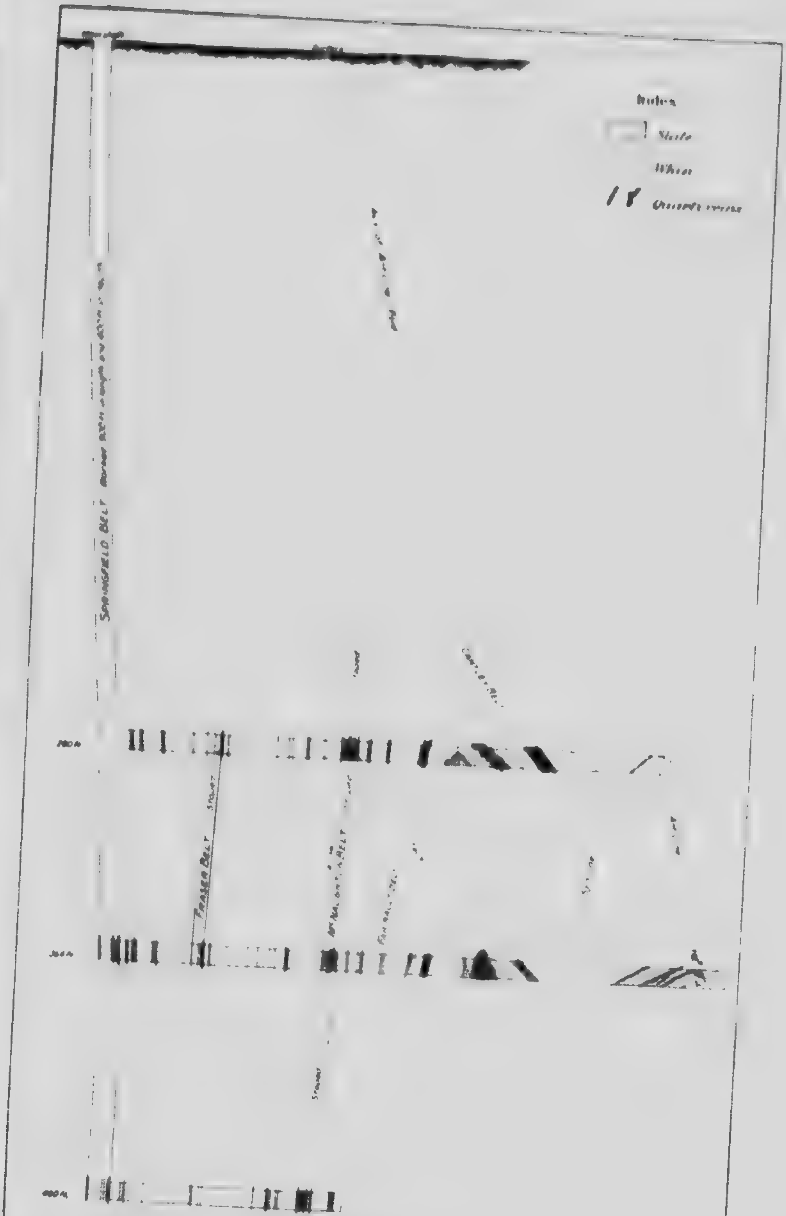


FIG. 10. Transverse section of Bluenose gold mine, Goldenville.
9869—p. 234

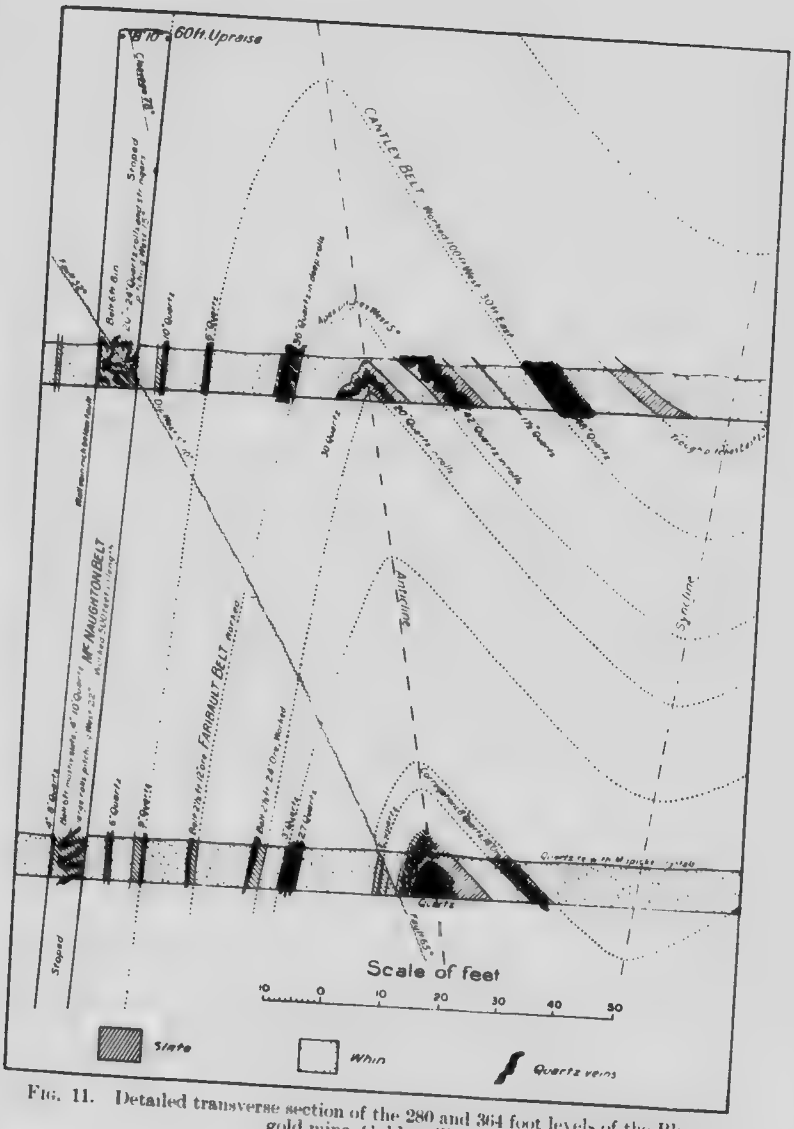


FIG. 11. Detailed transverse section of the 280 and 364 foot levels of the Bluenose gold mine, Goldenville.

m
f
t
c
o
a
m
90
ca
th
th
on
wo
ar
op
th

ap
de
ad
fee
the
foo
150
whi
stru

al. r
leng
whi
grou
affor
oper
T
utili
1
2
3

extent of developments. A common method of removing the ore from the large belts on the south side of the anticline was the open-cut, while on the narrower leads on the north side numerous shafts were sunk on the dip of the lead and the ore stoped out between these. The zones of pay-shoots are clearly indicated by the locations of the workings. In very few cases did the shafts extend to more than 400 feet deep on the incline, and it may be that some of the pay-shoots have not been worked out. The main zone of pay-shoots in the north limb could have been exploited by cross-cuts driven from a vertical shaft sunk to the north of the group of veins, and the continuation of such a shaft to greater depth, along with a system of cross-cutting and drifting, would explore new ground and open up a possible continuation to greater depth of the zone of special enrichment. Cross-cutting from some of the present shafts might open a few ore-bodies not yet worked out.

[1] An interesting piece of exploratory work [illegible]as done on the Blue Nose property. The Springfield belt was work[illegible]ughout a length of 900 feet and to a depth of 400 feet. It was [illegible] that by cross-cutting towards the anticlinal axis other auriferou[illegible]ht be found. Three cross-cuts were, therefore, driven north from th[illegible]ld belt at depths of 280, 364, and 460 feet and were carried respectiv[illegible]ngths of 230, 250, and 290 feet. Several belts not exposed on the surface were cut. The most important of these, known as the McNaughton, was worked about 900 feet in length and 245 feet in depth: on the bottom level stoping was carried 200 feet west and 30 feet east and the west face of the level showed the vein to be thicker than the east. The structure of the belt indicated that the pay-shoot dipped west. The ore was not so rich on the apex as on the leg of the saddle. Another belt known as the Cantley belt was worked on the north leg sufficiently to show that the workable portions are restricted to certain parts of the subordinate flexure. Further developments may reveal pay-shoots dipping east 10° to 20° with the plunge of the flexure.

[2] As the McNaughton belt has been profitably mined almost to the apex of the fold, 145 feet above the lower [3] level, we may conclude that the denuded portion of the Springfield belt, about 150 feet, was pay-ore which, added to the depth worked, 400 feet, would give a possible total depth of 550 feet of pay-ore on the south dipping veins. The McNaughton belt may, therefore, be expected to carry pay-ore for 400 feet deeper than the 364 foot level. On the south dip the zone of pay-veins is thus approximately 150 feet in width and lies immediately south of the anticlinal axis, along which it extends to great depth, unless a change should be found in the structure of the fold, of which there is so far no indication.

'A continuous zone of pay-veins has been worked to limited depths all along the south limb of the Goldenville anticlinal fold, for an aggregate length of 4,400 feet, from the Springfield to the Palmerston belt, beyond which development has been prevented by the swampy nature of the ground. The surface developments are sufficient to prove that this zone affords a field of virgin ground, large enough for several mines like that operated by the Blue Nose Company.'

The 33 foot fall on Liscomb river, 7½ miles from the district, could be utilized for mining operations.

[1] Faribault. Geol. Sur., XV, 423 A, and 179 AA.
[2] Geol. Sur., Can., XV, 424 A.
[3] The second level, which was then the lowest level.

[1] Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1862	2,023	0	0	663	3	1	0
1863	3,304	14	12	3,454	0	19	8
1864	3,419	14	20	2,673	1	6	8
1865	3,424	1	21	2,511	1	7	6
1866	5,829	13	8	2,853	2	0	20
1867	9,463	18	0	7,578	1	5	15
1868	7,070	0	5	9,880	0	14	7
1869	5,546	11	16	11,500	0	9	15
1870	7,134	4	0	11,428	0	12	11
1871	6,579	19	7	13,882	0	9	9
1872	4,188	9	21	5,243	0	15	17
1873	5,026	0	4	7,187	0	15	9
1874	4,037	1	2	5,430	0	14	20
1875	5,818	15	10	6,443	0	18	1
1876	5,176	15	15	6,205	0	16	16
1877	8,237	3	10	8,654	0	19	1
1878	6,843	1	15	9,340	0	14	17
1879	7,389	17	15	9,209	0	16	1
1880	4,042	7	9	6,465	0	12	12
1881	2,580	2	20	5,279	0	9	18
1882	2,542	17	14	6,251	0	8	3
1883	3,356	18	17	8,470	0	7	22
1884	2,668	11	0	3,268	0	16	7
1885	1,238	11	0	2,426	0	10	2
1886	1,341	3	9	2,850	0	9	10
1887	585	3	5	2,413	0	4	20
1888	535	8	18	2,858	0	3	18
1889	213	17	7	1,618	0	3	0
1891	119	5	0	464	0	5	3
1892	179	8	20	893	0	4	0
1894 (year ending Sept. 30)	552	16	12	708	0	17	0
1895	1,942	2	0	3,397	0	11	10
1896	2,796	8	9	5,945	0	9	9
1897	4,181	18	19	12,659	0	6	13
1898	5,201	4	10	16,891	0	6	3
1899	5,118	1	6	18,437	0	5	13
1900	4,763	12	9	17,711	0	5	9
1901	3,114	6	21	16,503	0	3	18
1902	3,720	9	0	15,412	0	4	20
1903	3,820	12	12	19,221	0	3	23
1904	1,564	17	12	11,297	0	2	18
1905	1,053	1	20	4,729	0	4	1
1906	805	11	0	4,525	0	3	13
1907	113	0	0	560	0	4	[illegible]
1909	28	6	2	61	0	9	7

[1] This includes the production of Cochrane Hill and Crowsnest.

SOUTH BRANCH STEWIACKE.

This is situated on South Branch Stewiacke river in southern Colchester, and is reached from Stewiacke station on the Intercolonial railway. The Halifax formation is here folded in an anticline the limbs of which dip at a high angle. There are several interbedded and some small cross veins and it is said that the latter are the richer. A large

cross-vein, three-fourths of a mile to the west of the group of veins on the river, is auriferous.

[1] A discovery of gold was reported from Stewiacke in 1865, and in 1867 there was quite an excitement in the district; prospecting was carried on with considerable success and there was talk of erecting a crusher. In 1884, a crusher was rebuilt and a few tons of ore milled, and in 1906 and 1907 some work was done by E. P. Crowe, but mining has not been carried on to any extent. Auriferous drift has been found at different places along the anticline following the ridge running from Gays river to Newton brook and forming the watershed between the upper part of the Musquodoboit and Stewiacke rivers. Several interbedded and cross veins have been prospected along the anticline. Some of the cross veins are very large.

Production.

Year.	Mine.	Ore crushed.		Gold recovered.		
		Tons.	Cwt.	Oz.	Dwt.	Gr.
1906 .	Crowe, E. P	19	12			
1907 . .	Crowe, E. P.	181	14	24	18	

SOUTH UNIACKE.

Location.

South Uniacke gold district is situated on the Dominion Atlantic railway, on the boundary line between Halifax and Hants counties, the mines being situated half a mile east of the station.

Geology.

The deposits occur on a subordinate anticline on the north limb of and about 2 miles north of the axis of an anticline passing through Lewis, Sandy, and Shubenacadie-Grand lakes. The upper part of the Goldenville formation is here exposed in a small anticline with an undulating axis 2 or 3 miles long. The Halifax formation is exposed half a mile north. On the south side of this small fold the strata dip at a low angle until they reach the syncline a short distance to the south, while on the north side the dip increases until it becomes vertical at a distance of 900 feet. The axial plane, therefore, dips to the south at an angle of about 45°.

Character of the Deposits.

[3] All the veins worked in this district lie in the stratification planes on the north limb of the anticline. The only veins that have been worked to any extent are the Hard and Slate leads. A rich and wonderfully regular streak, dipping east at an angle of about 28°, has been worked on three different properties on the Hard lead for a total length of 1,200 feet on the incline. Parallel with this and above it about 40 feet in the same vein was another pay-shoot smaller and less important. The thickness of the paying part of the vein was 4 to 5 inches and the rest was only 1 to 2 inches. The Slate lead lying south of the Hard has been worked throughout a length of 1,800 feet to depths of 100 to 400 feet and

[1] Rep. Chief Commissioner of Mines, Nova Scotia, 1865, p. 9.
[2] Rep. Chief Commissioner of Mines, Nova Scotia, 1867, p. 9.
[3] Faribault. Geol. Sur., Can., XII, 180 A.

at the 300 foot level there is 800 feet of stoping. The auriferous part of this vein extends farther west than that of the Hard lead, but not so far east.

History.

The details given in the reports of the Department of Mines, Nova Scotia, are not complete enough to furnish a connected history of the operations of the district, but a study of the gold returns shows that almost continuous work was carried on in this district from the time of the discovery until 1900, and resumed for two or three years since then.

A discovery was reported in 1887, and the next year energetic mining was carried on by J. J. Withrow and continued to be carried on with most satisfactory results for several years. In 1889, the property to the east of Withrow's was opened by Mr. Thompson and rich ore was reported. This mine, known as the Thompson and Quirk mine, continued a steady producer for several years, the ore being crushed at their 5-stamp mill, designated the Eastville crusher. The following is a statement of the official returns from this mine:—

Year.	Ore crushed.	Gold recovered.		
	Tons.	Oz.	Dwt.	Gr.
[1] October 1889 to December 31, 1891	298	3,201	15	
1892	180	1,803	4	18
1893	115	1,175	6	11
1894	129	790	3	2
1895 (5 months)	66	104	10	[illegible]

The same Company did some work on the Slate lead to the south, and in 1893, they had a shaft 325 feet deep on this lead. The Slate lead was also mined by the J. J. Withrow Mining Co.—Mr. Leedham, manager and in 1897, this Company had four shafts from 100 feet to 225 feet deep, and had stoped a length of 900 feet. Active mining, presumably on this lode, was continued by this Company evidently until some time in 1899.

In 1894, the Golden Lode Mining Co., Ltd., acquired areas on the Hard lead east of Thompson and Quirk's property and under the management of A. A. Hayward a vertical shaft 403 feet deep was sunk, which cut the rich pay-shoot at a depth of 375 feet. A 5-stamp mill was erected and the pay-shoot was followed on its dip to the east. Very rich ore was taken from this mine during 1894 to 1896, inclusive, but in 1897 there was a change in the character of the ore to the east, the quantity of the ore raised this year was much reduced, the yield per ton was less, and at the time of the inspector's visit the mine was idle. W. A. Sanders, however, did a little work here subsequently.

Work was started again on the Slate lead on the old Withrow property by the Victoria Mining Co., in June, 1902, but little was accomplished until 1903. The 300 foot shaft was deepened to 400 feet, levels were driven, and some stoping done. In 1903, the manager, John Kenty had thirty-two men at work and the next year P. R. Cutris was manager and had about the same number of men employed. The Company closed down about the beginning of the fiscal year of 1905, and little has been done in the district since.

General Development.

The published plan for which the survey was made in 1899 shows the location and depth of the shafts. Future explorations may be governed by the fact that the rich ore already found in this district lies in a narrow zone intersecting the strata at a very slight angle at that part where the

[1] Can. Min. Manual 1896, p. 170.

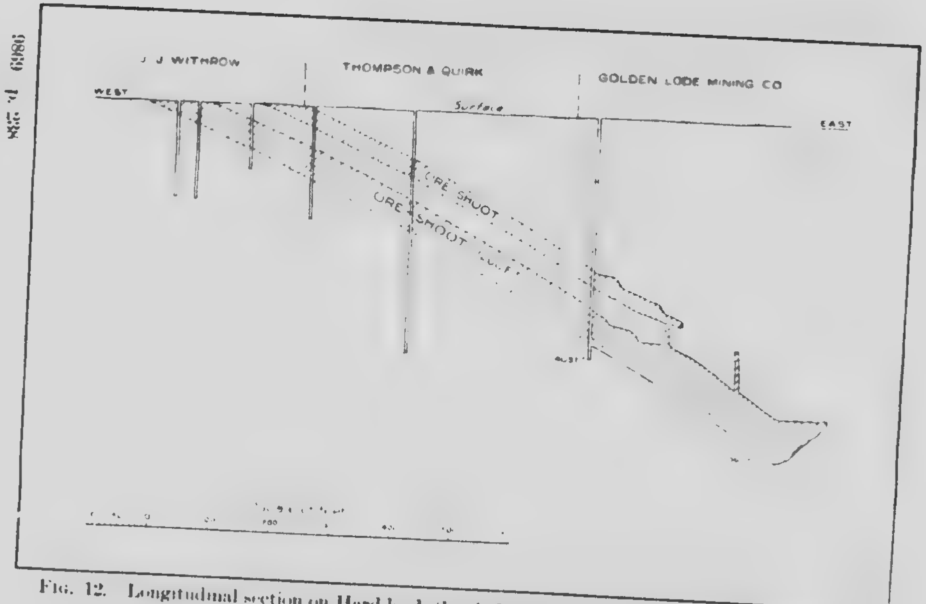


FIG. 12. Longitudinal section on Hard lead, South Uniacke, showing workings of Golden Lode mine and approximate position of ore shoots.

9869 p. 238

approach the vertical dip. It seems advisable that in prospecting leads north of the Hard lead operations should be directed to those parts lying to the east, and on those leads lying south of the Hard lead operations should be directed to those parts lying to the west.

The production is included with that of Mount Uniacke.

TANGIER.

Location.

Tangier gold district is situated in Halifax county, at the head of Tangier harbour and Pope harbour on the Atlantic coast. It lies 63 miles by post road east of the city of Halifax from which it is also accessible by water.

Geology.

[1]The Goldenville formation is here brought up on the Tangier-Harrigan Cove anticline, the most southerly anticline exposed on the mainland in the eastern part of the field. The fold runs east and west (magnetic) and plunges in both directions at angles less than 15°, forming a very long, narrow dome. The strata dip to the north and south at angles increasing to 70° thus forming a symmetrical fold with a vertical axis-plane. The rocks have been disturbed by two important series of faults, which have been located by the mining operations and surface explorations conducted in this district. These faults have a general strike northwest and south east and dip at high angles. The eastern series occurs on Strawberry hill in the eastern part of the district and consists of right-hand faults with horizontal displacements varying from a few feet up to 76 feet and aggregating some 280 feet. The western series lies in the vicinity of and west of the Essex mill and consists of left-hand faults with horizontal displacements varying from a few feet up to 150 feet and aggregating 170 feet. The block of strata between these two series of faults has thus been shoved some distance to the north. In one place fault breccia has been noticed attaining a width of 50 feet. The vertical displacement of these faults is not known and they present serious difficulties in mining.

A geological feature not known in any other gold district east of Halifax is the dioritic dyke striking north and south and cutting the strata at right angles. It has a uniform width of 40 feet and has been traced in a straight line for 2 miles to Grum point on the sea-shore. It does not affect the richness or size of the veins it cuts, and does not appear to be auriferous. There is no faulting along its plane and the only apparent result of the intrusion is the alteration of the intruded rock for a short distance on each side.

Character of the Deposits.

The veins are of the interbedded class and nearly all the work has been limited to those found on the south limb of the fold. Only a few veins have been opened on the north limb, and none to any extent.

Auriferous veins have been extensively developed for a length of over miles along a narrow and well-defined pay-zone. This zone touches the anticlinal axis at the centre of the dome, two areas east of the original free claim area, where it has a width of some 200 feet, and from this point it runs east and west bearing a few degrees to the south of the course of the anticlinal axis and not increasing very much in width. Within this zone the different leads have suffered enlargements and enrichments, which have been worked to the west on the Big South, Little South, Nugget or Kent, Nigger, Leary, Lake or Rose, Tennant, and Field leads; and towards the east on the Little South, Nugget or Kent, Twin or Dunbrack, Forrest and Wallace leads. The following notes on some of the most important lodes have been taken from reports by Silliman, Hind, and Townsend.

[1] Faribault. Geol. Sur., Can., XI, 157 A.

Lode.	Thickness in inches.	Remarks.
Big South	4 to 6	
Little South	2 to 3	Yield in early days averaged 3 ounces per ton
Kent or Nugget	12 to 24	Highly pyritous, quartz oily.
Negro	10 to 24	Crystalline quartz carrying calcite, siderite, pyrite, mispickel. Gold in showy specimens associated with calcite. Hanging-wall is quartzite filled with mispickel and pyrite.
Leary	6 to 10	Oily quartz with slate films, and mottled with blue or grey patches. Gold in crystalline particles in scales, and in threads and veinlets binding the quartz together. Associated with the gold are pyrite, mispickel, sphalerite, and galena. Hanging-wall is quartzite charged with pyrite and mispickel, and the foot-wall soft, dark blue slate with pyrite and mispickel in bunches frequently surrounded by dolomite and siderite.
Lake	6 to 10	Quartz oily and laminated.
Forrest	3 to 6	3 to 6 inches of slate crushed with the quartz. One of the most important veins of the district.
Dunbrack		A belt of leads, whin-bound, and furnishing about 1 foot of crushing material.
Wallace		Gives 6 to 24 inches of crushing material

A few veins have been tested on the western plunge of the anticl... at the mouth of Tangier river, the most important being the Fox l... There has also been a little prospecting west of the harbour. Much p... pecting has also been carried on for the source of rich drift found 450 feet south of the Essex mill.

History.

In October, 1860, Peter Mason discovered some auriferous quart... the bed of a brook a short distance north of Rush lake. As soon ... fact became known a number of people flocked to the locality to s... for the source of gold, but as the ground was frozen, and as Mr. M... was unwilling for them to prospect on his land, little was done unti... following year.

In April, 1861, the district was proclaimed and William A... proceeded to lay off mining lots measuring 50 feet across and 20 feet ... the supposed course of the leads. Nearly one hundred of these lots ... soon leased, at an annual rental of $20, and in a short time abou... men were engaged in mining or prospecting. Among the pioneers o... district may be mentioned Captain Archibald and Messrs. Murphy, L... and Barton. Many of these, however, soon became discouraged and ... to seek their fortune in other districts, in many of which gold was ... covered this year. O. C. Marsh, writing to the *American Jou... Science and Arts*, Vol. XXXII, Nov., 1861, states that two crushe... then nearly completed. One of them was very similar to the a... and 'consisted, essentially, of two large granite boulders, attach... short ropes to a horizontal beam, on either side of an upright ... around which they were drawn by a pair of horses. The quartz w... on a paved floor and kept wet, and as crushed by the boulders ... were dragged over it.'

By 1862, twelve auriferous veins had been opened, the richest of wh... were supposed to be th South, Leary, and Nigger. The South lead was

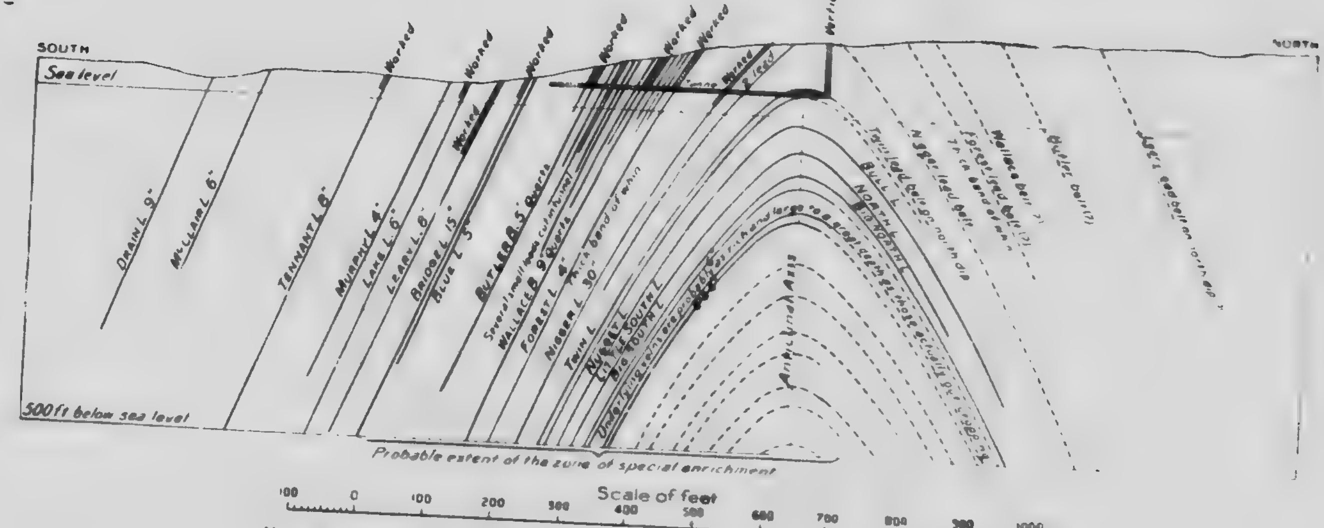


Fig. 13. Section across anticlinal fold between Copper and Rush lakes, Tangier gold district

traced 1,300 feet and [illegible] shafts were sunk varying from 60 to [illegible] feet in depth. Several shafts, although yielding well, had to be abandoned on account of difficulties with water. The yield per ton was from [illegible] ounce to 6 ounces. The Nigger lead was traced 2,500 feet and a 60 foot shaft was the deepest sunk, much of the quartz not being rich enough to pay expenses. The Leary lead was worked [illegible] although the average yield was estimated at 1 ounce. [illegible] upwards of 1,000 feet and [illegible] The Wallace vein was also worked.

Much difficulty was encountered in these early days [illegible] the small size of the areas. The shafts were too numerous for [illegible] no plan could be made for [illegible] size of the areas would not justify the erection of any but the cheapest and crudest machinery, there could be no system of control of the water, and often the water from one [illegible] had to be exercised to keep it in [illegible] on the property of [illegible] neighbour. The result was that many [illegible] were abandoned and [illegible] was of a very superficial nature.

In 1863, great numbers of these areas passed into the hands of companies who aimed at buying up a lot of adjoining areas, sufficiently [illegible] to justify the company in erecting proper machinery and initiating an economical mining system. Some difficulty arose through the [illegible] of many lessees or the defective nature of the titles. However, during this year there was very little mining done by the small proprietors, and practically all the mining and milling was in the hands of three or four companies.

One of these was evidently the New York and Nova Scotia Gold Mining Co., on whose property B. Silliman reported in February, 1862. [illegible] accompanying the report shows their property lying between Rush and Copper lakes, extending north from Rush lake and including the Lake, Leary, and portions of Negro, Kent, South, and North lodes. Development had been pushed chiefly on the Leary and Negro lodes and a tunnel driven north to cut the Negro lode. There was a 24-stamp mill, two Chilian mills or edge stones and round buddles to concentrate and save the auriferous sulphides. There were also two kilns constructed of quartzite and calculated to hold 25 or 30 tons each. To fill, fire, and discharge a kiln required three days. The concentration of the ore was rendered more difficult by calcination, and although the heated ore, when quenched with water, was more friable and could be milled more rapidly, it was the opinion of many experienced men that calcination was not economical.

We learn from Silliman's report that a company had drained Copper lake with the hope of finding fabulously rich placers, but had been disappointed. On sinking pits to the underclay and washing the dirt, gold could be found in small unrounded nuggets, but not abundant enough to satisfy the company and the enterprise was abandoned.

To the west of Copper lake was the property of the Atlantic Mining Company. At the close of 1863 there were three steam and three water mills in the district.

During 1864 the production was not so great as had been anticipated from the preparations made in 1863, but the following year there was some improvement. During 1865 alluvial washing was commenced, but was hindered by the dryness of the season. In 1866 vigorous operations were carried on and the yield of gold per man engaged was greater than any previous year. During this year some large and rich specimens were taken from this district. The Nigger and Leary lodes were worked by Messrs. Barton & Co., but work on these lodes was discontinued in 1867. In 1867, Mr. Forrest did some work on Strawberry hill and continued operations there for a number of years. The next year four shafts were worked on the Forrest lode, and three on the Dunbrack lode and a 200 foot tunnel was driven to cut the Wallace lode. In 1869 operations were continued on the Forrest and Wallace lodes and another lode, about 70 feet north of the former. During this year the property of the New York and Nova Scotia Gold Mining Company was purchased by H. R. Fletcher and the Burlington Gold Mining Company proceeded to work the Leary, Nigger, and other leads. Prospecting was continued also by Messrs. Barton and Estey and a 200 foot tunnel was driven, which cut several lodes.

During 1870 and 1871 mining in this district was brisk. The Burlington Company stoped the Leary and Nigger leads and connected the Leary and Lake leads by a tunnel. The crusher of 8-stamps was enlarged to 16 stamps. The mine was closed during the June quarter of 1871, but work was afterwards resumed. The production of this mine for 1870 was 518 ounces from 1,104 tons, and in 1871, 180 ounces from 388 tons. The Strawberry Hill Company was particularly active. A 10-stamp mill was in operation and the Wallace, Forrest, Hill, Tunnel, and Dunbrack lodes were worked, the Dunbrack and Forrest receiving the most attention, and the latter being by far the most productive. Several shafts were sunk, levels driven, and underhand stoping carried on. The production of this Company for 1870 was 838 ounces from 789 tons, and in 1871, 1,154 ounces from 1,212 tons. A report made on this property by H. Y. Hind, in October, 1871, was accompanied by a plan and a diagram showing the stoping on the Forrest lode. In 1870, Andrew McG. Barton did some prospecting and mining on the property adjoining the Strawberry Hill property. He had an 8-stamp mill, run by water-power. These two years were the most productive in the history of the district.

After this came a long period during which much of the work of the district was in the hands of tributers.

In 1872, tributers did a little work on the property of the Burlington Gold Mining Company on the Leary and Lake leads, and some prospecting on the Big South lead.

On Froud's property some work was done on the Hill and Dunbrack leads and the Strawberry Hill Company was active during a part of the year. Mr. Forrest, as a tributer, worked the Little South lead on the areas of the Tangier Mining Company, stoping it out 300 feet in length to a depth of 25 feet.

In 1873, the Strawberry Hill Company was at work. Mr. Forrest was the principal operator, and his tribute right on the Tangier Mining Company's property having expired, he abandoned his work on the South, the Little South, and North leads and prospected on Strawberry hill. He discovered a lead, but abandoned it the following year to work on the Dunbrack, which lies about 200 feet to the south. Tributers on Froud's property succeeded in discovering a promising 7 inch lead on areas 234 and 235, and some excitement was produced by the striking of rich quartz on the Field lead near the river. The next year the chief operations were on Strawberry hill, the Dunbrack lead being worked by both Mr. Forrest and Mr. Townsend. Some work was done by Messrs. Ross and Miller on the west side of the river on a supposed extension of the Leary lead

Mr. Forrest carried on operations on the Murphy lead in 1875 and 1876, and erected an 8-stamp mill north of the lead, and Mr. Townsend worked the Dunbrack lead in 1875 and the Forrest lead in 1875 and 1876. In 1877, Mr. Barton opened one of the leads he exposed by his surface drift immediately to the north of the alluvial workings of 1867, and late in the year some tributers prospected on the Burlington property. In the following year work on the lead opened by Barton was discontinued and a lead on the same strike farther west was opened by three shafts. Near this also a supposed extension of the Nigger lode was opened. The Nigger was worked from the old tunnel and the well known Leary lead reopened by two sets of tributers.

In 1879, the Leary lode was worked during a part of the year, and Messrs. Barton and Murphy worked the eastern extension of the South and Nigger lodes. The Messrs. Ferguson worked the Field lode on tribute; the area containing this lode was purchased by Messrs. Torrance and Scaife, who purposed organizing a company and erecting a mill on the river. This property was worked the next two years by the Pittsburg Gold Mining Company, who crushed their ore at a 10-stamp mill run by water-power, which they had erected on the west side of the river. In 1882 they discontinued operations.

For several years Mr. Townsend continued work on Strawberry hill. In 1879, the Forrest, Dunbrack, and Wallace lodes were worked; in 1880 the Forrest and Dunbrack lodes; in 1881, the Forrest lode on Butler's hill and the McDonald lead near the dyke were prospected, and in 1882 the mill was refitted and work was done on the Forrest and other lodes near the Mooseland road.

In 1880, Mr. Barton worked on the Blue lead during the early part of the year, but later transferred his operations to the Nugget lode. In 1881, the Satemo Gold Quartz Company purchased the Barton Washings, made extensive openings on the Nugget and Kent lodes, and erected a 10-stamp mill. They continued their operations on these lodes in 1882, during which year the Kent Gold Quartz Company worked the Kent and Nigger lodes, crushing their ore at the Pittsburg mill.

In 1883, mining was confined principally to Strawberry hill where the Brunswick Gold Mining Company overhauled the mill, erected new buildings, and carried on operations on the Forrest lead in the vicinity of the Mooseland road. The next year work continued, and in 1885 a little was done by the Essex Gold Mining Company and on Strawberry hill by Mr. Townsend. For several years the production continued to decline until in 1889 it was so small as to be included in the Report of the Department of Mines under the heading 'Other Districts.'

The work on Strawberry hill was least interrupted, and a little work was reported from this mine nearly every year until 1891.

In 1886, Mr. Miller worked on the Leary lead and Mr. Murphy on the west end of Nugget lode. In 1887, the Essex Gold Mining Company reopened and worked their mine for a time. In 1889, John Murphy and others did a little work, and in 1892, Mr. Murphy, who never lost faith in the district, was still at work. In 1895, he had five men at work on the Essex property and in 1896 he was still on the property working the Nigger lead. In this year, Messrs. Fox, Watts, and Clements worked the same lead, but farther west on the Kent property.

In 1898, there was a marked revival of activity in the district. Miner Foster secured by purchase or option the western half of the district and sold to the Tangier Gold Mining Company. Active operations on the Leary, Nugget, and Murphy Twin leads led to a great increase in the production of this district. The 10-stamp mill in the eastern part of the property which had been driven by water-power was remodelled and ten additional stamps put in. This Company continued work in 1899 under the management of A. E. McPhail and sinking, drifting, and stoping were done on the Little South, Twin, Nigger, and Fox leads.

During 1900 and 1901 the mines were worked by the Worcester-Tangier Gold Mining Company and sinking, driving, stoping and a small amount of cross-cutting were done.

The mines shut down in September, 1901, but were reopened in June 1902, by the Tangier Amalgamated Mining Company, Ltd. Arch. McPhail, manager. Little underground work was done in 1902; a little stoping was done on the Nugget lead, the Kent shaft was opened and retimbered, and the driving of levels was started. In 1903 work was confined principally to the Kent shaft, but little was done.

In 1905, a little work was done here on the Leary, Nugget, and Nigger leads by the Boston-Tangier Mining Company. Work started on the Nugget lead in October, 1904, but all operations ceased the following summer.

In June, 1906, the shaft on the Leary lead was reopened and sinking commenced by Joseph Mason for the Dominion Mining Company. Some levels were driven and a small amount of stoping done. The following year work was continued by the same Company under the management of A. L. McPhail, a greater number of men were employed, and 201 ounces of gold was extracted from 647 tons of quartz. Work was carried on on the Kent lead in 1908, the shaft was carried to a depth of 350 feet, and at the 340 foot level a cross-cut was driven south cutting the Murphy Twin and Nigger leads, on both of which levels were driven. A cross-cut was also started to the north. In the latter part of 1908, the Dominion Mining Company contracted for an electric plant to be driven by water-power, and in 1909 this plant was completed, and it is expected that the cost of operating the mine will be greatly reduced by the transmission of electric power to all parts of the district where needed. In April, 1910, the main shaft was 400 feet deep and the cross-cut to the north had been extended to a length of 133 feet, cutting the Little South, Big South, and three other leads not seen on the surface.

General Development.

The published plan for which the survey was made in 1898 gives a good idea of the extent to which operations have been carried on. Although

a great many shafts have been sunk on the different leads the most of them are 100 feet or less in depth, several are between 100 and 150 feet, only three or four are over 200 feet, one on the Leary lead being [illegible] feet in 1907, and one on the Kent lead being 400 feet in 1910. It seems probable that in many of the veins the bottom of the paying ore has not been reached. However, it may be that the pay-shoots do not extend to a very great depth in any of the veins. The pay-zone does not appear to have a great width, being only 200 feet wide at its centre and not much wider at the east and west, and, as its dip is probably parallel with the axis plane of the fold and, therefore, vertical, and the veins dip between 55° and 65° to the south, the southern limit of the pay-ore may be reached at no great depth, especially on the southerly veins. Cross-cutting to the north will have to be done in order to keep in the pay-zone and open the rich portions of lower veins.

The western ends of the Little South and Big South leads seem to be favourable ground for deeper work since they were sufficiently rich to be worked to depths of 100 to 140 feet on lots only 50 feet by 20 feet in the early days. It seems probable that the early miners, under such conditions, were not able to reach the bottom of the good ore.

[1]Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1862	865	0	0	707	1	4	11
1863	494	7	21	655	0	15	2
1864	602	7	8	698	0	18	10
1865	644	7	13	639	1	0	4
1866	296	5	21	791	0	7	11
1867	691	1	7	724	0	19	2
1868	921	8	9	725	1	4	7
1869	1,192	3	10	1,332	0	17	23
1870	1,814	2	10	2,732	0	13	[illegible]
1871	2,095	0	7	2,924	0	14	7
1872	829	8	15	1,622	0	10	[illegible]
1873	726	11	15	1,070	0	13	4
1874	419	7	5	706	0	11	23
1875	448	2	15	1,106	0	8	1
1876	312	13	0	716	0	10	6
1877	410	14	15	364	1	2	13
1878	584	10	22	1,035	0	11	7
1879	857	7	12	1,464	0	10	6
1880	530	14	3	790	0	13	10
1881	399	9	16	716	0	11	3
1882	789	11	16	1,622	0	9	17
1883	798	11	18	1,140	0	14	0
1884	924	2	19	1,330	0	14	0
1885	431	9	14	874	0	9	9
1886	360	19	14	936	0	17	17
1887	311	10	13	738	0	8	10
1888	263	1	0	539	0	9	18
1889	112	4	12	427	0	5	6
1891	13	3	12	42	0	6	6
1892	103	8	0	311	0	6	[illegible]
1893	390	12	13	1,183	0	6	18
1894	464	7	0	1,469	0	7	[illegible]
1896	85	11	0	593	0	2	21
1897	299	14	0	372	0	16	2
1898	1,341	0	0	1,154	1	3	17
1899	1,000	15	0	2,553	0	7	20
1901	436	10	0	936	0	9	8
1908	256	0	0	567	0	9	1
1909	63	0	0	180	0	7	0

[1] Includes the production of Mooseland.

9869—p. 244

Power plant, Dominion Mining Company, Tangier

UPPER SEAL HARBOUR.

Location.

Upper Seal Harbour gold district is situated in Guysborough county at the head of Isaac harbour, and about 2½ miles north of Isaac Harbour gold district. It is reached by coach from Antigonish on the Intercolonial railway, and by packet from Halifax.

Geology.

The Goldenville formation is here exposed in a closely-folded anticline having a general course of N. 60° W. (magnetic). This anticline plunges to the east at an angle increasing from 10° at the west end of the district to 32° at the east end, while the strata on both limbs have about the same inclination to the north and south, the angle of dip increasing from 50° near the apex to 80° some distance from it. Work on Dolliver mountain shows that the axial plane dips south 4½°. The fold is sharper at the Dolliver Mountain mine than at the Richardson mine and it flattens still more farther east. Even on the Richardson vein a broadening with depth is quite perceptible.

The fold is affected by three main faults, and as the greater part of the district is covered with drift the location of these faults becomes a matter of some importance in tracing the anticlinal fold along which the ore deposits so far worked are found to lie.

The eastern fault has been indicated on the plan as lying west of Dolliver Mountain gold mine along the north branch of Davidson brook, but more developments made by G. J. Partington on the Dolliver Mountain property have shown that it more probably follows the course of Davidson brook in a southwest direction to the harbour where it joins the main harbour fault. This has a horizontal displacement of 400 feet to the north on the east side.

The Middle fault, known in Isaac Harbour gold district as the main harbour fault, lies here 600 feet west of the mouth of Isaac Harbour river and follows the general course of Northwest Branch brook to the head of the harbour, down which it runs, passing between Hurricane island and the eastern shore. By this fault the anticline is shoved 1,100 feet to the north on the east side.

The western fault runs parallel to the latter along the valley of the south branch of Smelt brook of Country harbour, and is well seen at the Porcupine rock.[1]

Character of the Deposits.

The veins all follow the planes of stratification and some of them attain a great thickness on the apex, in some cases over 20 feet, thinning down on the legs. The Howard, Forge, and Partington veins were found to measure respectively 10, 30, and 33 feet vertically on the apex and to become much thinner on the legs, while the Richardson belt showed a thickness of 20 feet on the apex, 7 feet on the north leg, and 8 feet on the south leg. Underground developments like those at the Dolliver Mountain mine where a vertical shaft was sunk on the apex of the anticline have proved a succession of saddle veins. Operations have been restricted to the apex or its vicinity and it seems that the conditions for ore deposition lay within a short distance of the anticlinal axis.

[2] The Richardson belt is the one on which the great proportion of the mining in this district was done. It consists of a belt of quartz and slate lying between well-defined walls of quartzite. The foot-wall is a thick belt of quartzite. It is cut by a network of angulars, very numerous at the apex but decreasing in number with distance from it. The angulars running into the hanging-wall are also more numerous on the apex than elsewhere. The quartz of the vein is very irregular in quantity and distribution throughout the thickness of the belt: in some places almost the whole belt for a width of 6 or 8 feet is quartz, while in other places the quartz may entirely disappear. As a rule the proportion of quartz

[1] Faribault, Geol. Sur., Can., X, 105 A.

[2] E. Percy Brown, Min. Soc., N.S., XIII, p. 18.

is greater near the apex and on the apex little or no slate is to be seen. At the apex, the quartz is white and coarse-grained and carries a little arsenopyrite in masses, but where it thins down on the legs it is of a ribbony structure. The faults affecting this vein are all small, run in various directions, and generally die out in less than 100 feet.

Although the greater part of this belt has been milled and has furnished a large body of low grade ore, careful sampling and assaying on the 400 foot level showed that the gold is not evenly distributed, but is concentrated in zones, one on each limb of the anticline, and investigations point to the probability that these pay-shoots dip to the east, at about the same angle as the plunge of the anticline, but recede from the anticlinal axis with depth. In the 400 foot level, driven on each leg of the saddle, the face was sampled and assayed after every cut, and at the same time one battery was cut out and run continuously on test crushing.

[1] The quartz on the apex was a dense glassy quartz of low value and containing little slate or sulphides. This continued for a considerable distance on the south side and the walls were smooth and regular. At a certain point a marked change became evident both in the character of the walls and of the vein. The hanging-wall became shattered and the lead became impregnated with mispickel embedded in a velvety black slate, while assays and mill tests showed an increase in the gold content. This condition continued for 200 feet along the level, when the walls again became smooth and regular and the quartz formed in narrow veins interlaced with slate of a different character, containing a very small amount of sulphides. The level was continued 600 feet farther west, but no further discoveries were made. In a level 150 feet above this, similar conditions were found to exist and stoping was carried along the lower limits of the pay-shoot.

The same conditions were found on the north leg, and at a point 600 feet from the apex the vein commenced to widen and increase in value, while the slate became black and impregnated with sulphides. This continued along the level 300 feet and its maximum thickness was 22 feet. Stoping revealed clearly the line of the roll and the bottom of the shoot was outlined.

The underground explorations of the Dolliver Mountain Mining Company exposed several large saddle veins, but few, if any, of these were sufficiently auriferous to be profitable.

Three of the East Goldbrook belts have been tested to a depth of about 150 feet. They form a somewhat broader saddle than the Richardson and lack the heavy quartzite walls of the latter. One of these has a marked enlargement at the shoulder on the south side and in this some remarkably rich ore was found. Further development may prove a zone of enrichment affecting the shoulders of the other belts. Two thousand feet east of these belts two veins have been opened.

There has also been some development work on each side of the line between the Richardson and McMillan properties. Prospecting has been carried on all along the anticline as far as Country Harbour, but nothing of any account discovered.

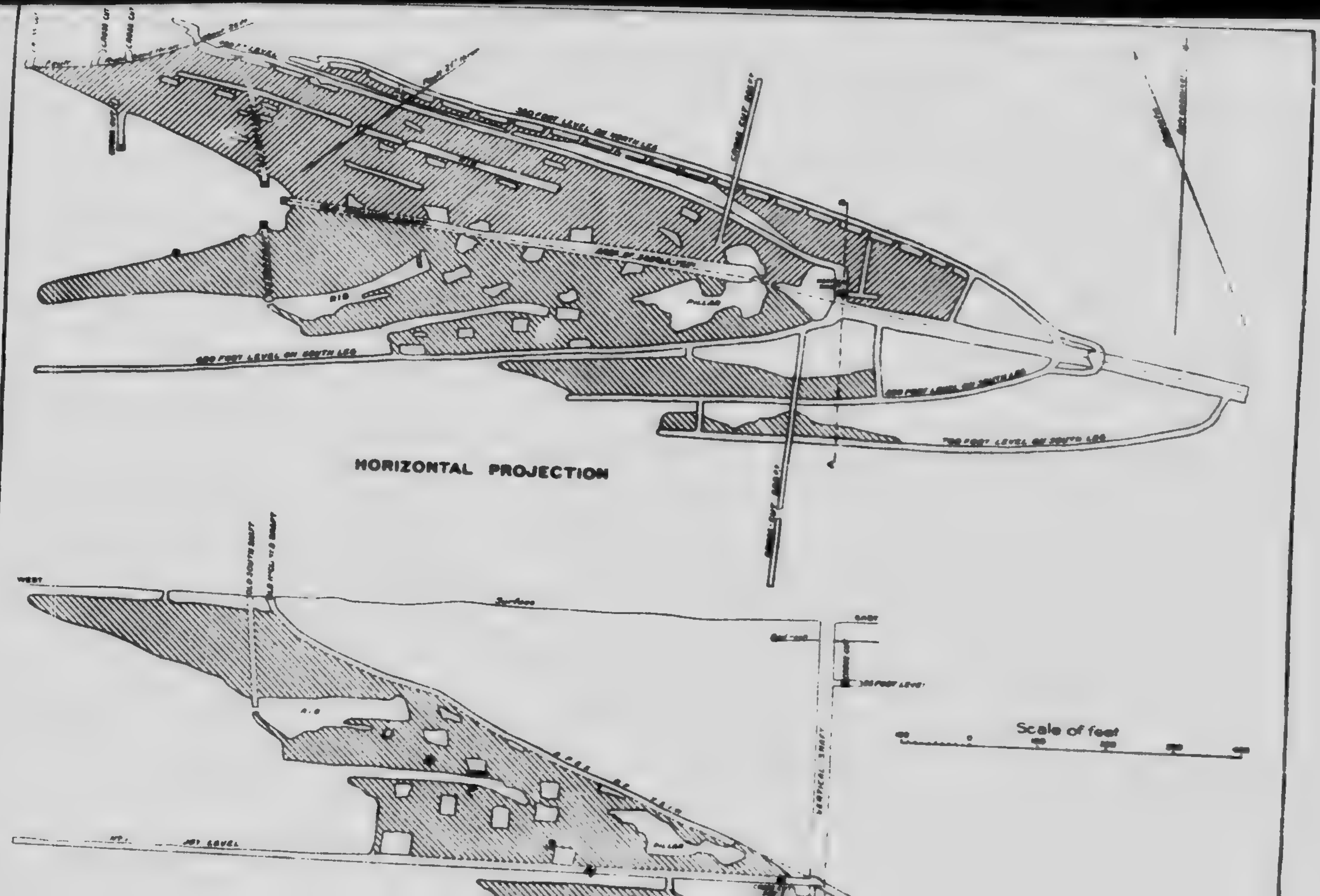
History and Development.

More or less prospecting had been done in this locality for a number of years, but it was not until in 1892, on the occasion of the tracing of the anticline through this section by the Geological Survey, that Howard Richardson made the discovery of the large body of low grade ore afterwards known as the Richardson belt.

The history of this district is in the main the history of the Richardson mine, which has been worked almost continuously from the time of its discovery until very recently and has turned out a great quantity of low grade ore, approximately 375,000 tons, from which a little over 50,000 ounces of gold was recovered.

In the year of its discovery, 1892, preparations were made by the Richardson Gold Mining Company for carrying on operations, and thirty-one men were employed by C. F. Andrews in erecting buildings and put-

[1] H. S Badger, Jour. Min. Soc., N.S., XIII, p. 89.


HORIZONTAL PROJECTION
Scale of feet

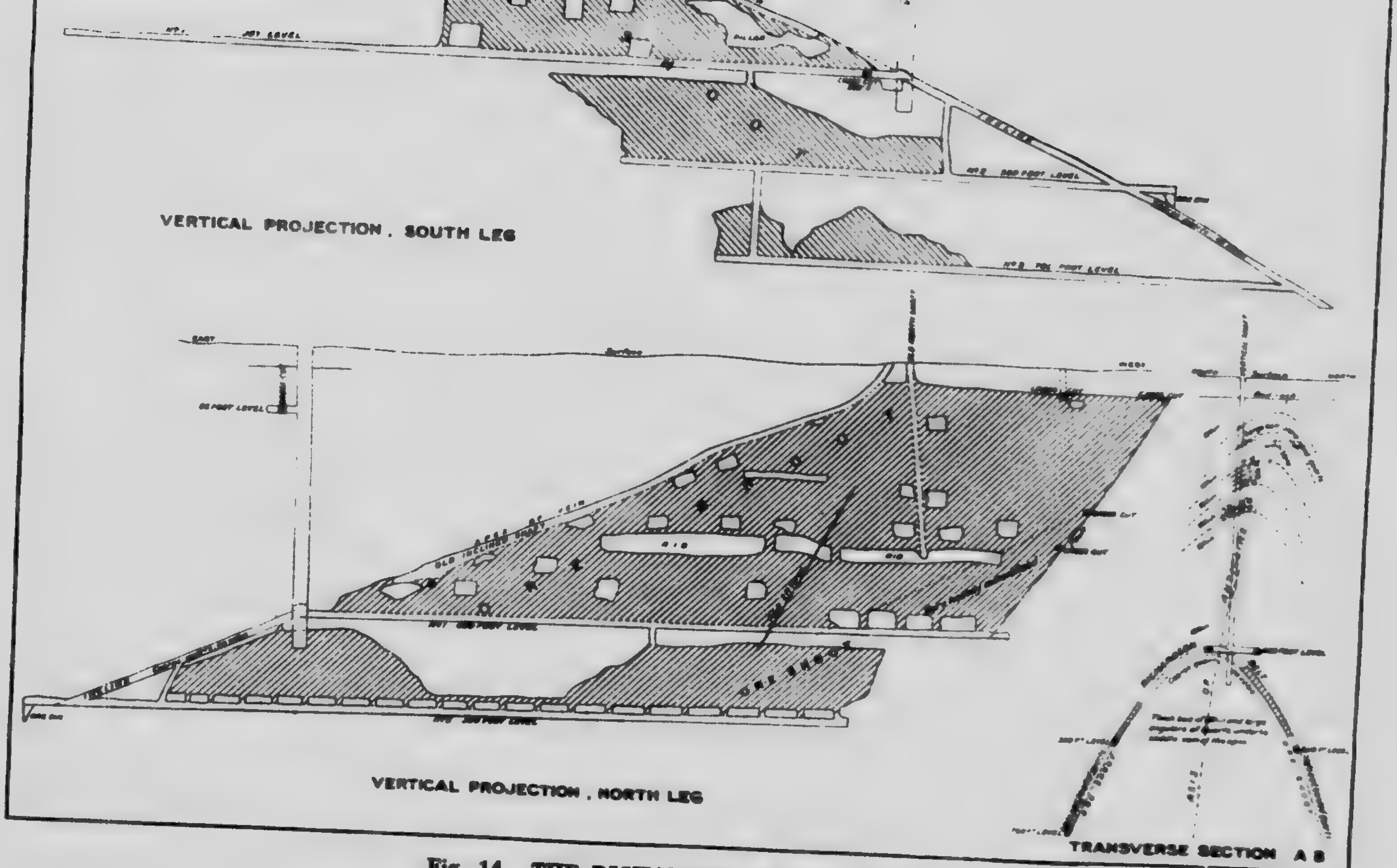
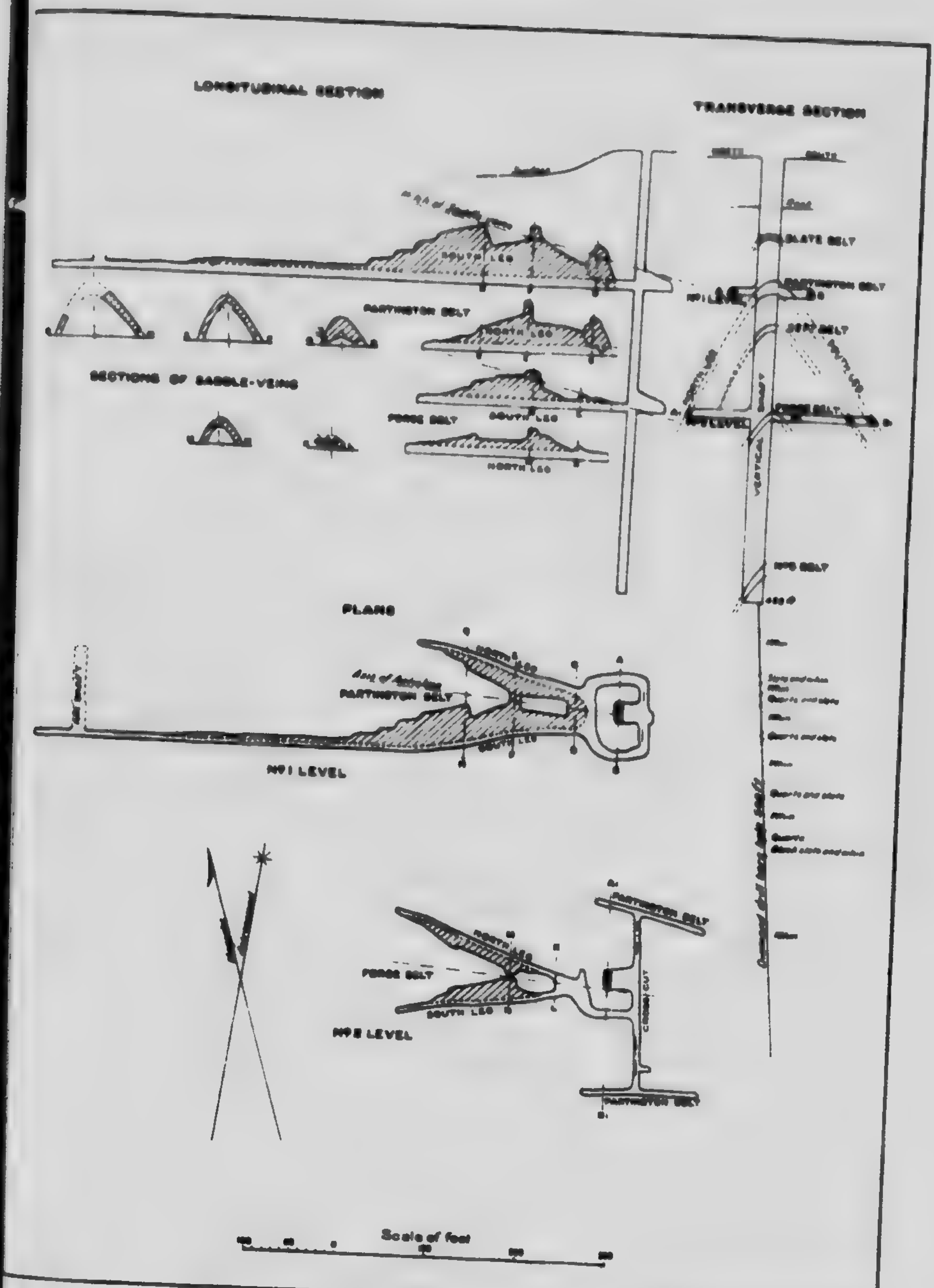


Fig. 14—THE RICHARDSON SADDLE VEIN
UPPER SEAL HARBOUR GOLD DISTRICT

To accompany Memoir No. 20



To accompany Memoir No. 20

Fig. 15—DOLLIVER MOUNTAIN MINE

UPPER SEAL HARBOUR DISTRICT—1905

ting
stam
and t
prov
tinue
of 15
ment
from
stam
Augu
on un
then
at th
make
Se
recove
opened
umber
south
trator
worth
this v
similar
depth
west of
substan
1900, n
530 feet
year tw
and a
In 1901,
vigorou
great p
further
the sout
level va
was qua
up to si
tables.
In 1
was take
shaft tha
overlying
of 150 to
a cross-c
were tre
had been
plant wa
The rest
for before
made wit
In M
Richardso
pended ow
vein here
been left
the men
pillars in
To efficien
to enlarge
the east of
was made
under the
visit it wa
at a depth
able quant

ting up a 15-stamp mill. This mill, which was soon increased to twenty stamps, was running early in 1893. In July the shaft was down 90 feet, and the next year prospects were such as to justify remodelling and improving the machinery so as to increase its efficiency. Work was continued in 1895 and the shaft on the south dip was continued to a depth of 156 feet. In 1896 work was vigorously carried on under the management of C. R. Andrews and ore was carried by a trestle 1,200 feet long from the shaft to the mill situated on the side of the lake. Twenty new stamps were added to the mill, thus making it a 40-stamp mill. In August, 1897, sixty-five men were employed and operations were carried on under the management of A. B. Fox. The shaft on the south side was then down 195 feet and on the north side 125 feet, and a raise was started at the east on the apex of the anticline, which when completed, would make the third shaft, all of them worked from the one shaft house.

Seventy-five men were employed in 1898, and 2,478 ounces of gold was recovered from 24,121 tons of ore. The east inclined shaft, which had been opened, was down 260 feet and the south one 240 feet. Owing to the poor timbering in the mine several falls of rock occurred this year, one at the south side of the main shaft being a very serious one. A Wilfley concentrator treated the tailings from the mill. In 1899, 150 tons of concentrates worth $45 per ton had been saved from the tailings from twenty stamps and this year the other stamps were raised so that the tailings could be similarly treated. The eastern or main inclined shaft had reached a depth of 400 feet and another shaft was started on the north dip 200 feet west of the north shaft. All the old workings were retimbered in a very substantial manner, and large pillars were left to support the [illegible]. In 1900, ninety-six men were employed, and the eastern or main shaft was 530 feet deep at an angle of about 21° and the north shaft 280 feet. This year two Wilfley concentrators were run and two more were to be [illegible] and a Rand air compressor, capable of running eight drills, was [illegible]. In 1901, the main shaft had reached a depth of 620 feet and stoping was vigorously carried on on both legs of the vein by the underhand method, great precautions being taken to provide against the possibility of any further crushes of the hanging-wall, similar to that which took place on the south leg in 1900. The thickness of the ore body around the bottom level varied from 4½ feet to 15 feet and of this 60 per cent to 70 per cent was quartz. Twenty additional stamps were erected bringing the number up to sixty, and the concentrates were recovered by means of four Wilfley tables.

In 1902, the main shaft was deepened to 760 feet, and 20,000 tons of ore was taken out from which 3,459 ounces of gold was recovered. A vertical shaft that had been sunk to the east of the workings to test other veins overlying the Richardson had been allowed to fill with water. At a depth of 150 to 200 feet in this shaft a vein had been cut on the south dip and a cross-cut driven to the north. During a part of the year the tailings were treated without concentration in an extensive cyanide plant that had been brought from the Cariboo district the preceding autumn. This plant was owned by J. R. Stuyvesant and managed by H. S. Badger. The results of the treatment appear not to have been satisfactory, for before the end of the year the cyanide plant was closed and tests were made with the bromo-cyanide process of treating concentrates.

In May, 1903, this property passed into the hands of the Boston-Richardson Mining Company. In March, this year, mining was suspended owing to an extensive crush which destroyed the main shaft. The vein here pitches at a low angle to the east and insufficient support had been left to sustain the great weight of the hanging-wall. Fortunately the men were at the time in the lower levels partially protected by the pillars in those workings, and made their exit by way of the north shaft. To efficiently continue work on the main belt the new Company started to enlarge and deepen the vertical shaft that had been sunk 850 feet to the east of the old shaft house. It was enlarged to 19 feet by 6 feet and was made a three-compartment shaft. This shaft was continued in 1904 under the management of H. Plavter, and at the time of the inspector's visit it was about 410 feet deep. Eight veins were cut in the sinking and at a depth of 386 feet a seam of gouge was cut and below this a considerable quantity of quartz mixed with the rock. This proved to be the

Richardson belt. A station was made at 400 feet and levels were driven on both the north and south legs of the saddle. From April to June, 1905, the underground works were practically idle while the plant was being overhauled and repairs made. Experiments were conducted by Messrs. Badger and Brown in the bromo-cyanide process, and six Wilfley concentrators were put in.

About June, 1905, H. S. Badger was made manager, and with the help of E. Percy Brown, instituted a thorough system of sampling and mill testing which showed that all portions of the vein were not equally auriferous, but that the great proportion of the gold was found in shoots. The north level was driven 360 feet and the south one 320 feet and ore was removed by the overhand method. Thirty stamps were kept running and the concentrates were treated by the bromo-cyanide process. An ingenious method was devised for keeping a record of the extent of the development and stoping. In addition to the ordinary mine plans and sections, there was constructed a model of the mine as it would appear were all the rock above the belt removed. The model was constructed to scale and as underground operation progressed portions of plaster of Paris representing the belt were cut away to show the levels driven, and the areas stoped.

In 1906, the following officials were in charge: Franklyn Playter, general manager, H. S. Badger, superintendent; John Warner, foreman; E. Percy Brown, chemist and assayer. There were 126 men employed, and the 400 foot level on the south leg was extended to a length of 1,220 feet and that on the north leg 1,010 feet. A rib 20 feet to 30 feet high was left above the levels to take the place of timber covering, chute holes being put through at intervals of about 50 feet. Of the ore mined only about half was hoisted, the balance being held as reserve in the mine. From the south leg and 90 feet from the shaft a cross-cut driven 500 feet to the south intersected five belts varying from 1 foot to 36 feet in thickness. The bromo-cyanide plant was operated successfully and gave an extraction of 70 per cent of the gold in concentrates running from \$15 to \$25 per ton. Considerable prospecting was done this year and some promising belts were opened on the East Gold Brook property acquired from F. S. Andrews and others.

The following is an abstract taken from the monthly statement of the Boston-Richardson Mining Company for August of this year:

No. of tons crushed	3,939
No. of tons concentrates produced	82·72
Value of ore per ton, determined by assay	\$ 2 94
Value of concentrates per ton	17 00
Total value recovered	3 55
Cost of operation of mine per ton	1 08
Cost of operation of mill per ton	19
Cost of operation of cyanide plant per ton ore	10
Cost of cyaniding concentrates, per ton concentrates	4 39
General maintenance of plant	53
Total cost of operation per ton	1 90
Average crushing per stamp per 24 hours ....tons.	2·98

Stoping was done on the 400 foot level in 1907, but the levels were not extended in length. In January of this year an incline shaft 23 feet by 10 feet was started on the apex of the anticline from the 400 foot station. This was sunk 475 feet at an angle of 25°, and at a point 360 feet from the 400 foot station levels were driven north and south; in September these were in 265 feet and 235 feet respectively. The concentrates averaging about \$17 per ton were treated at an average cost of \$2.33 per ton, and an extraction of 70 per cent to 80 per cent of the gold was made. A higher percentage of extraction could have been made, but the increase in the gold obtained would not equal the extra cost. The tailings from the cyanide plant, consisting of 40 per cent to 50 per cent gangue necessary for successful percolation, were reconcentrated by means of Wilfley tables so that they contained 39 per cent to 40 per cent arsenic. They were then shipped to Germany where they were paid for according to the arsenic content. Seven men were engaged in development work on the East Gold Brook property. A shaft 12 feet by 5 feet was sunk 175 feet, some cross-cutting was done, and levels were driven, the longest one 260 feet, being

Surface plant of the Boston Richardson Mining Co., Upper Seal Harbour.

the 8 foot south belt. In 1908 the main incline was continued to 700 feet, and ore was stoped from the 550 foot level, the south leg of which was continued to a length of 730 feet and the north leg 1,085 feet. The 700 foot level was driven on the south leg 181 feet. Owing to financial difficulties operations were discontinued on August 15, but were soon resumed.

In 1909 work was continued here by the New England Mining Company H. S. Badger, superintendent—and on an average eighty-eight men were employed. Most of the stoping was done on the 550-foot level, the 700 foot level was driven on the south leg 629 feet during the year making the total length 808 feet from the face to the shaft, and a raise was cut from the 700 foot level to the 550 foot level. Early in the summer an old 85 foot shaft in the western end of the Company's property was cleaned out and at a depth of 75 feet a level was driven east 56 feet. A cross-cut driven north from a point 6 feet east of the shaft cut two belts, one at 66 feet and the other at 72 feet, and on the former a level was driven 60 feet east. This Company crushed, during the year ending September 30, 41,425 tons of ore yielding 5,024 ounces of gold, 82·6 per cent of which was recovered by amalgamation and 17·4 per cent by bromo-cyanide extraction from 1,171·5 tons of concentrate. Of the 588 tons of arsenical concentrate 446 tons were shipped to Swansea, Wales.

The discovery of the large Richardson belt in 1892 did much to stimulate prospecting along the same anticline and considerable exploratory work has been done, but it has resulted in very little profitable mining.

Two leads were opened on the H. Richardson property at the east, and in 1903, Howard Richardson reported a small recovery of gold.

The chief exploratory work was carried on west of the Richardson property. Several shafts were sunk on the North and South leads dipping south on the McMillan property, but no great depth was attained.

Important operations were carried on for a time on Dolliver mountain. More or less prospecting was done here in the nineties and in 1896 returns were made of 69 ounces recovered from 155 tons.

In April, 1901, the Dolliver Mountain Mining and Milling Co., Ltd., was organized, with G. J. Partington as vice-president and general manager. This year twelve men were employed, chiefly in prospecting and development work on the surface, but it was the intention of the Company to push the sinking of a vertical shaft, which had been sunk to a depth of 60 feet, the purpose being to develop and mine belts of ore that would be cut during the sinking on the anticline.

Surface work progressed rapidly and water-power was developed; at the time of the inspector's visit in 1902, two dams had been constructed as well as a sluice and 44 inch flume to carry water to the powerhouse 1,000 feet from the lower dam. A 16 inch McCormick turbine was put in as well as an electric plant and electric power was transmitted to the shaft for hoisting. An air compressor was also erected and a foundation laid for eighty stamps. The shaft, measuring 17 feet 6 inches by 4 feet 6 inches inside timbers, had been sunk to a depth of 190 feet and at a depth of 130 feet had cut a belt of ore 32 feet thick, named the Partington belt.

In 1902, the shaft was deepened to 265 feet, cutting a 22 foot belt named the Forge belt. A station was cut on the Partington belt and levels were driven on the north and south legs 150 feet and 200 feet respectively. An air shaft was started on the south leg 450 feet west of the main shaft to connect with the level being driven. Forty stamps were erected and crushing began in June, the tailings being concentrated by four Wilfley concentrators. This year returns of 170 ounces were made from 6,326 tons of ore.

In 1904, this Company took advantage of the act passed by the provincial government by which a part of the cost of sinking a deep shaft was to be paid out of the public purse in order to test the feasibility of carrying on deep mining operations. On May 25, the work was commenced under conditions imposed by the Commissioner of Mines. At this time the shaft was down 330 feet and sinking was continued to a depth of 488 feet. Since the inspection in 1903, the south level on the Partington belt was extended to 645 feet and at 583 feet a raise was made to the air shaft. The level on the north leg was extended to 204 feet and ore was stoped from both levels. A station was cut on the Forge belt and levels were

driven, south 180 feet and north 194 feet, but little stoping was done. Cross-cuts were driven from this station to the Partington belt, on which short levels were driven. The returns for this year were 205 ounces from 8,059 tons.

Sinking under the Deep Mining Act was discontinued, and, in 1905, from the bottom of the 488 foot shaft a drill hole was put down 500 feet along the anticlinal axis, and, although several bodies of quartz and slate were struck, the results were not satisfactory, and shortly after this the mine was allowed to fill with water, and has since remained idle.

The production for this district is given with that of Isaac Harbour.

VOGLERS COVE.

Volgers Cove mine lies in the southwestern part of Lunenburg county 2 miles north of Volgers Cove, a village on Port Medway harbour. The village is 8 miles from County Line station on the Halifax and Southwestern railway.

The vein on which the most of the work has been done lies about a mile south of the axis of the Indian Path anticline running southwest. The Goldenville formation is exposed and the strata strike 40° and dip south 60° to 70°. The vein is a cross vein running north (magnetic) for some distance, then turning and running 335° (magnetic). It dips west 75°. [1]It is 2 feet thick, but increases to 9 feet at the point where it changes its direction. Towards the south it splits into two parts 18 inches and 2 feet wide. The pay-streak is 2 feet wide and dips north 30°, is well mineralized, and carries visible gold. The thick part of the vein is not good. Another vein on which a shaft has been sunk 50 feet lies 650 feet northeast, is 10 feet thick, runs northwest, and is nearly vertical.

According to newspaper reports some prospecting was done here during the eighties. The discovery of the principal vein is credited to Augustus Reinhardt. The Report of the Department of Mines for 1895 states that at that time there was a 5-stamp mill, and a little gold had been reported two or three years before. In 1899, J. Munroe was in charge of work on a narrow vein on the 'mill site' property on which a shaft had been sunk and levels were being driven. There was a 5-stamp mill on the property. On the Liverpool Co.'s property, Messrs. Brown, Crowe, and Hutt had some men employed sinking a shaft. Levels were driven in 1901, and in 1904 mining operations were being carried on by the Vogler's Cove Mining Company—A. B. Stewart, manager—but ceased late in the year. [2]The main shaft is 125 feet deep. At the bottom of this a level is carried 30 feet south, and at a depth of 90 feet levels are carried north 40 feet and south 60 feet. Thirty feet south from the main shaft is another one 70 feet deep, from the bottom of which a level is run 35 feet south.

A mile and three-fourths northeast of this is the Dr. Cowie mine. Two shafts, 45 feet and 50 feet respectively, have been sunk on a slate belt carrying three quartz leads. Half a mile east of this is another 50 foot shaft on the same belt. This dips south 45° and is about 1,000 feet south of the anticlinal axis.

WAVERLEY.

Location.

Waverley gold district is situated in Halifax county, 12 miles north of the city of Halifax and 2 miles from Windsor Junction. There is a station in the district on the Dartmouth branch of the Intercolonial railway. Lakes Thomas and William divide the district geographically into two parts known as East Waverley and West Waverley.

Geology.

[3]The anticline exposed here is the western continuation of the Moose River anticline, runs N. 80° E. (magnetic) and plunges west at angles

[1] Report Dept. of Mines, N.S., 1904, p. 74.
[2] Report of the Department of Mines, Nova Scotia, 1904, p. 74.
[3] Faribault. Geol. Sur., Can., XI, 151 A.

Surface plant of Dolliver Mountain Gold Mining Co., Upper Seal Harbour.

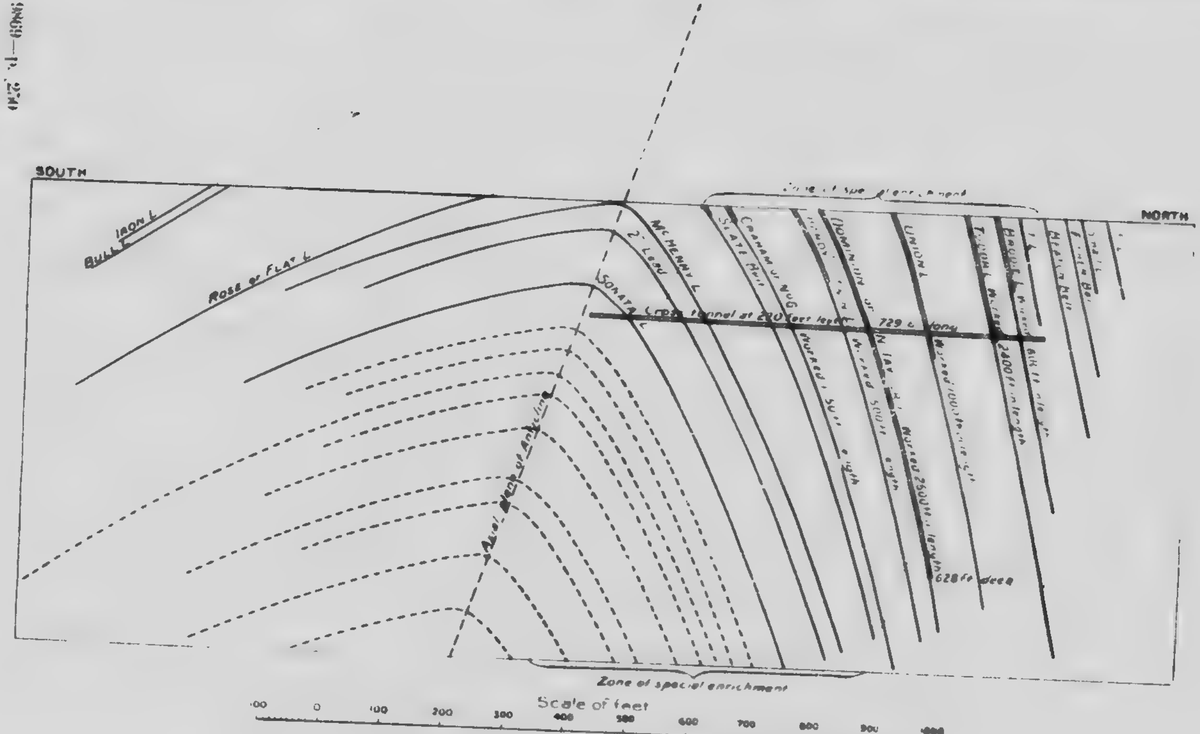


Fig. 16. Section across anticlinal fold on Tudor mine, Waverley gold district.

9869—p. 250

varying from 0° to 35°. It is an unsymmetrical fold with the north limb dipping north 70° and the south limb dipping south 45°. Denudation has been so extensive as to expose strata deposited 7,000 feet below the Halifax formation.

There has been considerable faulting. The principal fault passes up Lake William and Lake Thomas and passes immediately to the west of the short run uniting the two. The horizontal displacement is 800 feet to the south on the east side of the fault. Another fault giving a shove of 118 feet to the south on the east side runs by the railway station and through Muddy pond. It dips east at an angle of 40° and has been located in the underground workings of the Lake View mine. Another line of disturbance was located by surface trenching at the southwest cove of Lake Thomas, but the displacement does not appear to be extensive. In the western end of the district is another probable fault passing through Threemile lake and Powder-mill lake

Character of the Deposits.

The veins follow the planes of stratification. Although quite a little work in the western section was conducted on the south limb of the anticline and numerous shafts were sunk on the Nigger, O'Toole, and South Tudor leads, the high dip on the north limb seems to have furnished conditions more favourable for the deposition of ore-bodies, and nearly all the important veins are situated on this limb. Here a series of veins lying in a zone 600 feet wide has been worked for a considerable length and to depths in many places between 200 and 350 feet. Some, especially those to the north, were found to decrease in size and value, thus indicating the northern limit of the pay-zone. A shaft sunk 628 feet on the dip of the Dominion lead showed a decrease in thickness from 15 inches on the surface to a mere film of quartz with lenticular pockets at a depth of 500 feet. The pay-zone probably lies parallel to the axial plane of the fold dipping south at an angle of 69°. Among the most important leads worked in the western section are the Tudor, Brodie, Union, Dominion, North Taylor, Twin Taylor, No. 9, and No. 6.

In the eastern section the Barrel lead on Laidlaw hill is the only one of importance. This lead aroused a great deal of interest at the time of its discovery on account of its supposedly unique structure. This was found to be a sheet of quartz lying on the apex of the anticline dipping north and south and plunging to the west, but the peculiarity that attracted attention was its corrugated appearance, where it was exposed after the removal of 2 or 3 feet of drift. Corrugations resembling the logs of a corduroy road ran parallel to the anticline and were found to continue beneath the overlying rock. [1]Another interesting feature of this vein is that where it was exposed a strip 25 feet long by 8 or 10 feet wide had the rolls or barrels planed off by glacial action, and the smooth and polished surface was crossed by the striæ continuous with those found on country rock on each side.

History.

Waverley was one of the first districts discovered and it quickly rose into prominence as one of the principal producing districts of the Province. Mining was very active during the sixties and early seventies, then interest waned, and it was only during the early nineties and the first three years of the present century that production again assumed any noticeable proportion.

The first discovery of gold in this district brought to the notice of the public was made by Alexander Taylor on August 23, 1861, on the edge of Muddy pond on the Waverley farm also known as the Allen farm. When the discovery became known it is said that the Hon. Joseph Howe drove to the locality, made investigations, and returned to Halifax with \$60 worth of specimens acquired from men who had broken them from the boulders during a two day's search on American hill. The next day there was a rush of gold hunters to Waverley. An association of Halifax merchants, called the Chebucto Mining Association, was formed to make

[1] B. C. Wilson, Trans. Min. Soc., N.S., Vol. II, pt. I, p. 40.

a thorough and systematic prospect of the Waverley farm, on which the exclusive right to search until May 1, 1862, had been acquired. Although this farm included all of what is now known as the west [illegible] of the Waverley district and by far the greatest number of auriferous veins, the Company was unsuccessful in discovering any lodes sufficient auriferous to warrant the taking up of any large area. On May 1, 1862, Alexander Taylor, however, exposed a gold bearing vein at the [illegible] where he had discovered the boulders the preceding year.

The discovery of other veins east of Muddy pond quickly succeeded, and soon active mining was carried on here. The most important vein here in the western division was the Taylor vein, which was first found on the free claim, selected by Taylor as discoverer. On the free claim a 40 foot shaft was sunk in 1862, including the Taylor and another vein 3 feet to the north, but the most of the ore was procured by open-cut. The same vein was opened on the area to the east [illegible] shafts one of which was 90 feet deep. Immediately to the south [illegible] veins were opened by the Wolfville Company, while operations were carried on on the same ridge of ground on the side of Lake Thomas by the Nova Scotia Gold Company, and in a width of about 80 feet over [illegible] veins were exposed. No fair test, however, was made of these veins during the year. Some prospecting was done west of Muddy pond, [illegible] of any consequence were discovered. Mining in the western division assumed no great proportions in 1862, and from 149 tons of ore 117 ounces of gold was recovered.

In the eastern division, on the other hand, extensive mining operations were carried on during this year. Gold was discovered on Laidlaw hill by James Skerry on September 11, 1861. His attention was first attracted to some loose auriferous quartz boulders embedded in drift about 3 feet deep, and on clearing away the loose material he discovered what he supposed to be a very wide vein of quartz. Subsequent examination showed that it was the apex of a folded and corrugated quartz vein. It was described by some as presenting the appearance of logs laid side by side like a corduroy road, and by others as resembling a series of small casks laid side by side and end to end and from this resemblance it was designated 'barrel quartz,' a term familiar to every gold miner of Nova Scotia. This barrel quartz received considerable attention in 1862, and was traced west 800 feet. To test its extension north two shafts, 36 and 55 feet deep, were sunk north of Willis brook, but the vein was not reached; its southerly extent was not tested. Mining was carried on by open-cut and during the year 6,592 tons of quartz was removed, of which 3,592 tons was crushed, yielding 1,360 ounces of gold. In 1863, 471 ounces were recovered from 2,370 tons of quartz.

During the next three years there was a steady increase in the production of the district and in 1864 it greatly exceeded that of any other district, while in 1865 it amounted to 14,404 ounces from 12,518 tons, considerably more than half that of the whole Province.

No details regarding the operations during 1863-5, inclusive, are given by the Chief Gold Commissioner or the Chief Commissioner of Mines, but F. P. Ronnan[1] has assembled some interesting information relative thereto. In 1863, an average of twenty areas were worked and among the principal operators were a number of German capitalists, including Messrs. Muller, Burkner, Franck, and Ellershausen, the last being manager of a number of areas formerly held by the Chebucto Mining Association on American hill. Thomas L. DeWolfe was manager for the Lake Major Company and the Rockland Mining Company and operations were conducted on a small scale. The average number of mines worked during the first three months of 1864 was eighteen; this increased to thirty during the second quarter, but fell back to ten during the remainder of the year. There were six mills in the district, and among the companies at work, one of the principal was the Rockland Co., which sank seven shafts on the Tudor lode, six on the Brodie, and six on the Union. Of the 14,404 ounces produced in 1865, over half was produced by Leopold Burkner who conducted vigorous operations on the Tudor lead on areas 161-165 inclusive. A yield of 8,727 ounces of gold was obtained from 7,000 ounces of qu[illegible]

[1] Ind. Advocate, May, 1898, p. 6

crushed at his mill. Other companies engaged in mining at Waverley during this year were The Waverley and Boston Co., the Taylor Gold Company, and the North American Company.

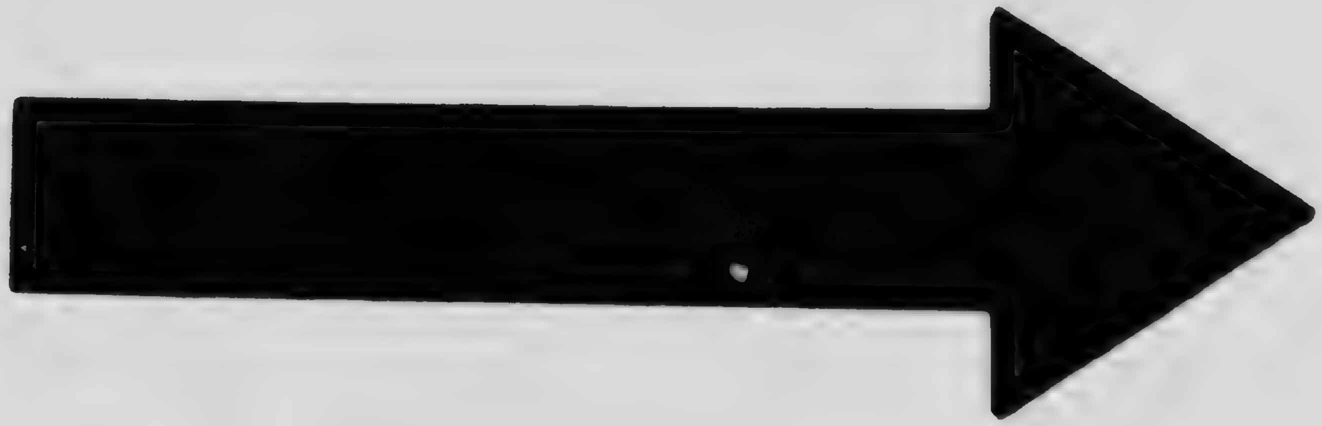
In 1866, the most extensive workings were on the Tudor lode. On this Burkner and Co. continued stoping and sinking and their deepest shaft reached 226 feet; to the east the Lake Major Company had nine shafts varying in depth from 198 to 251 feet, and still farther east DeWolfe & Co. had seven shafts the deepest of which was 160 feet. The Brodie lode to the north was worked by all three companies, while the last named Company also worked the Taylor lode east of Muddy pond by two shafts 100 and 130 feet deep. South of the Taylor lode, the Boston and Nova Scotia Co. sank four shafts on No. 6 lode, one of which was 180 feet deep, while on the same lode farther east the Waverley Company raised ore through a 140 foot shaft. The latter Company also worked a little on No. [illegible] Another lode that received some attention this year was the Nigger lode and on it the Stanford Company sank four shafts and started driving levels. Work was resumed this year by DeWolfe & Co. on the barrel quartz on Laidlaw hill which had been virtually abandoned three years previously.

During 1867, work was still carried on by Messrs. Burkner, DeWolfe, & Co., on the Tudor lead, but not so extensively as formerly. They also worked the Brodie lead and DeWolfe & Co. made a drainage cross-cut from one of their shafts on the Tudor lode to the Brodie lode. Mr. Burkner sank additional shafts on the Nigger lode and extended his operations on it. Little was done this year on the Taylor lode, but mining continued on the barrel quartz, and the Boston and Nova Scotia Company continued operations on No. 6 lode, extending their main shaft to a depth of 300 feet.

In 1868, the production was less than in 1867, and in that year Waverley lost the distinction of ranking first among the gold districts of the Province. This year the lodes chiefly worked were the Tudor, Brodie, No. 6, and Taylor. The deepest shaft on the Tudor lode on the Lake Major property was 325 feet deep, and on the Brodie lode 220 feet. Mr. Burkner's work was chiefly of an exploratory nature. The Boston and Nova Scotia Company, after continuing their shaft on No. 6 lead to a depth of 361 feet and stoping a portion of the vein, closed this mine, and directed their attention to the North Tudor lode. To arouse renewed interest in this district and to place in the hands of the miners information that would enable them to carry on their exploratory and development work more intelligently and systematically, Henry Youle Hind was commissioned to make a report on the district. This able report, accompanied by geological maps and sections, was published in 1869 and contains valuable information on the geology of the district, the nature of the ore deposits, the degree of development of the different properties, and hints as to how to carry on the work of mining more economically.

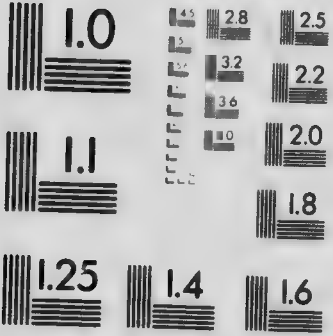
In 1869, operations were carried on by the Lake Major, Rockland, American Hill, and Waverley Gold Mining companies and by Leopold Burkner. Professor Hind's map of the geological structure of the district was confirmed by the tracing of the Tudor lead around the apex of the anticline and along the south limb a distance of 1,100 feet. On this South Tudor lead, Mr. Burkner sank five shafts and removed the ore by underhand stoping; he also resumed operations on the Nigger lode, sinking three shafts. A little work was done [illegible] the year on the barrel quartz. The work of DeWolfe & Co. was chiefly of an exploratory nature, but on areas adjoining their property the North American Company sank a shaft and stoped a portion of the North Tudor lode. Some little work was done east of Muddy pond, the Waverley Company doing a little stoping on the North Taylor lead, while the Boston and Nova Scotia Company and the Taylor Company, united under the name, The American Hill Company, continued on the lodes they had formerly worked.

In 1870, the production was the lowest that had yet been reported, [illegible]g only 811 ounces of gold from 2,619 tons of ore. Among the com[illegible]s engaged were the Lake Major and Rockland companies under the [illegible]intendence of Thos. L. DeWolfe and the American Hill and Waver[illegible] companies under the superintendence of W. H. Clarke. In the early



MICROCOPY RESOLUTION TEST CHART

ANSI and ISO TEST CHART No. 2



APPLIED IMAGE Inc

part of the year, Mr. Burkner worked the Nigger lode, a few tons of quartz was mined on Laidlaw hill, and late in the year mining was resumed on the Tudor lode. The North American Company sank on the North lode and stoped it. The American Hill Company worked the North and South Taylor leads and DeWolfe & Co. resumed operations on the Union lead.

The American Hill Company worked the North Taylor lode in 1871, but the next year let their property to tributers who did some stoping on No. 6 lead. DeWolfe & Co., during 1871 and 1872, worked first the Union lode, then the Brodie, but finally abandoned the latter and returned to the former. Early in 1873, however, DeWolfe & Co. abandoned all work and in the autumn the property containing the Union lead was let to tributers. During this year tributers were active on the American Hill property and also on Wilson's areas on Laidlaw hill. During 1874, tributing continued on Laidlaw hill, but was suspended on American hill, and Mr. McClure set his men to search for the continuation of the Union lead to the east. This was found, and yielded good returns.

Not much gold was taken from Laidlaw hill in 1875, mining being confined chiefly to the western division. Here the Union lead was worked on Mr. McClure's property adjoining that of DeWolfe. Some explorations were made on areas 174 and 191, but the Union lead on areas 169 and 170 was worked steadily and under Mr. Huff's management two shafts were sunk to a depth of 140 feet and ore stoped out that yielded very satisfactory returns. This year a Company known as the British Gold Mining Company took Mr. DeWolfe's property conditionally, put the stamp mill in repair, and put in working order five shafts on the Tudor lead, four on the North, and seven on the Union, but apparently with little success.

The principal work of the district in 1876 was on the Union lead, areas 169 and 170, where sinking on the main shaft was continued and stoping actively performed. Some stoping was done on the Dominion lead, and a little work on American hill, while the Barrel lead, area 156, was worked along the wall, the waste rock being stowed tight to the roof behind the miners.

In 1877, the production fell off considerably, much more in 1878, and for a number of successive years it remained very low. In 1877, work continued steadily on the Union lead, area 169, and for a time on the Dominion lead. Work, started the preceding year on American hill, was continued and the Graham lead was cut, but the results were disappointing. During this and the following year some tributers found a few rich barrels on Laidlaw hill, but work in this vicinity was almost completely suspended for a number of years.

In 1878, mining on the Union lead, area 169, was abandoned and the North Tudor or Brodie lead was opened on area 133, but little seems to have been done. In 1879, there was little activity in the district, the barrel quartz was tested by a shaft on area 113, the Wilder Brook and Johnstone lodes and some lodes on the Burkner property were tested, and T. J. Wallace reopened the mine on the lake shore and put up an 8-stamp mill. In 1880, a lode on the Burkner areas was stoped a length of 150 feet to a depth of 30 feet; Mr. McClure found a promising 15 inch lode to the west of his mill, and some other prospecting was done. A mill was erected during the summer for treating tailings, but work was suspended in the autumn.

In 1881, the lode found on the McClure property the preceding autumn was mined, and a little work was done by O'Toole and others. The next year work was continued on the McClure areas, and Mr. Huff found a promising lead on area 250. Little progress was made in 1881 in the treatment of tailings in this district, but the operation was more successful in 1882.

The district was greatly depressed during the eighties, but in 1885, Mr. Huff discovered a vein on American hill which he worked this and the following year. In 1887, Messrs. Wilson and Gue met with a fair measure of success in opening up new portions of the Dominion and Taylor leads. In 1888, a little milling was done and the largest returns were made by Messrs. McClure and B. C. Wilson. Late in the year preparations were started by Mr. Hayward for extensive operations on American hill.

Laidlaw mill, Waverley.

PLATE XXXVII.

9869

Laidlaw hill, Waverley.

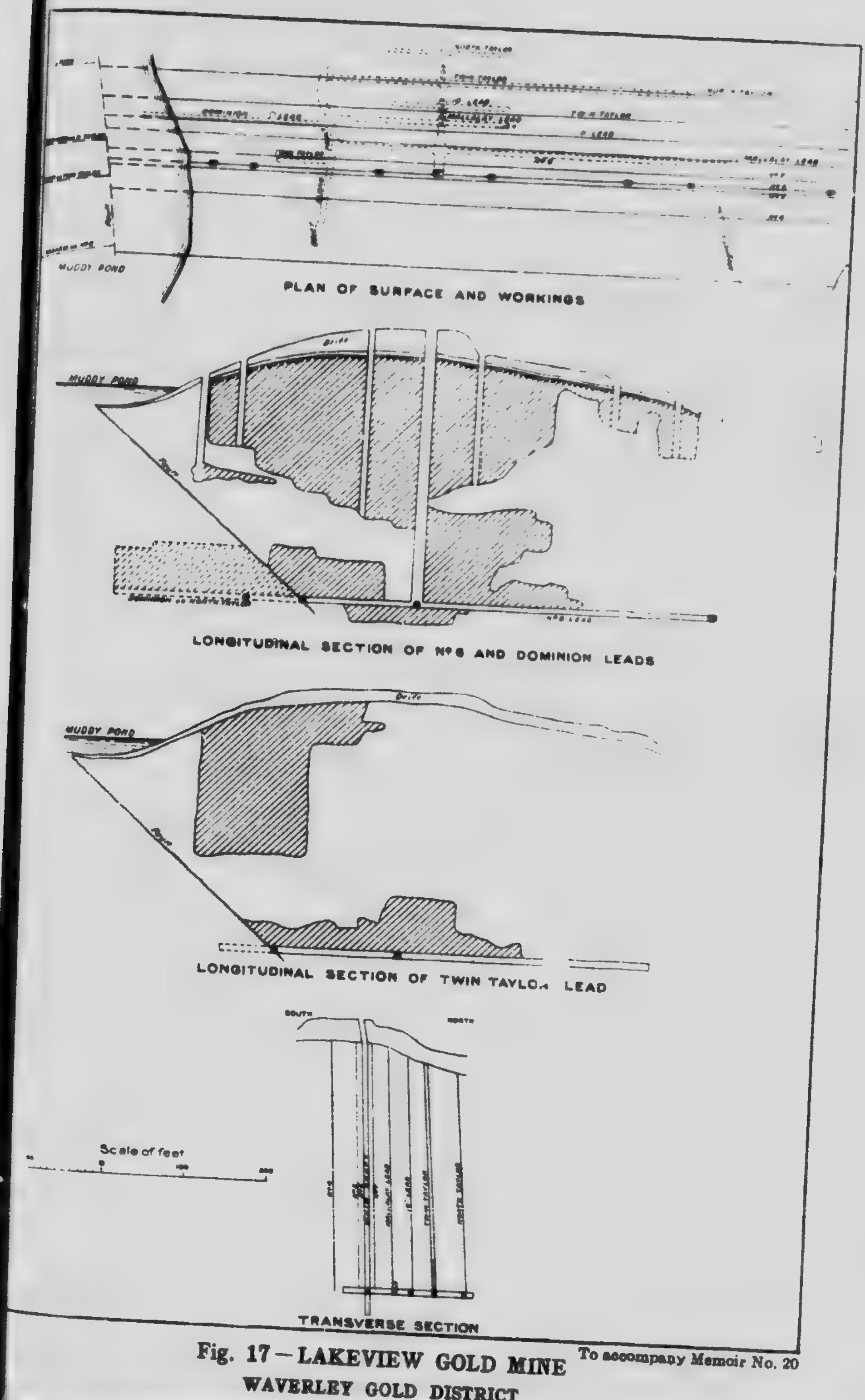
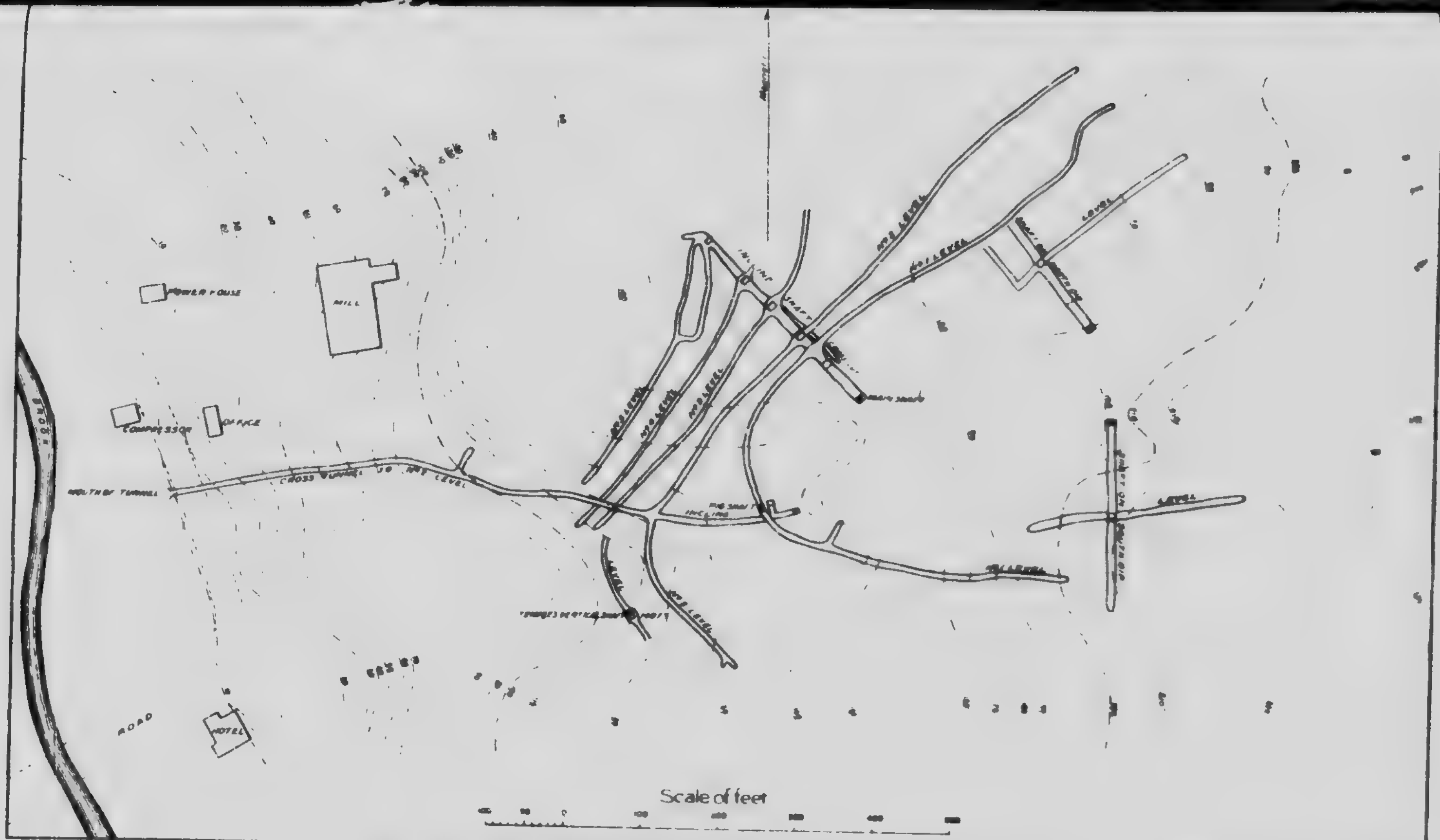


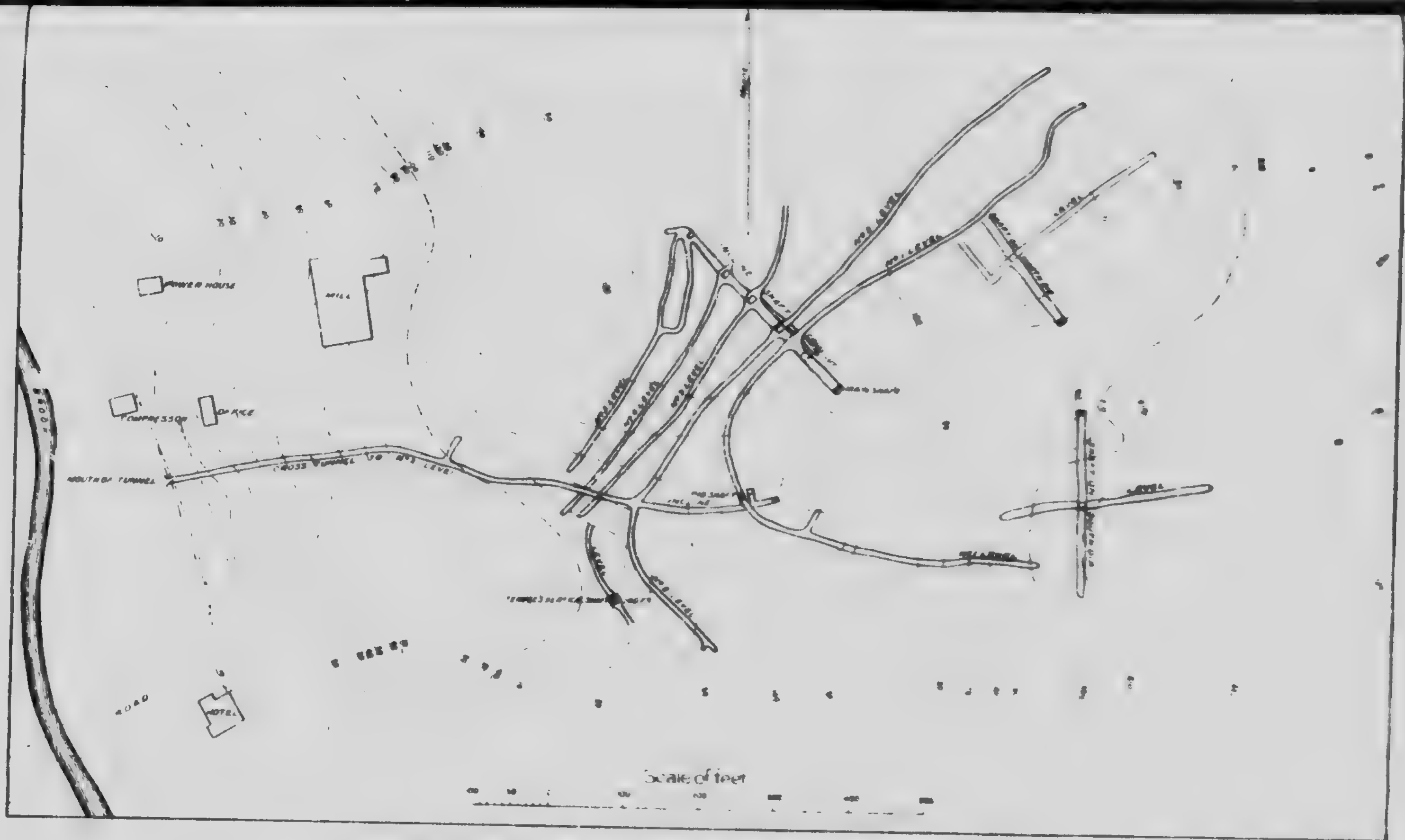
Fig. 17—LAKEVIEW GOLD MINE
WAVERLEY GOLD DISTRICT

To accompany Memoir No. 20



To accompany Memoir No 20

Fig. 18 PLAN OF WORKINGS ON BARREL QUARTZ LEAD
WAVERLEY GOLD MINING COMPANY
WAVERLEY



To accompany Memoir No 20

Fig. 18 PLAN OF WORKINGS ON BARREL QUARTZ LEAD
WAVERLEY GOLD MINING COMPANY
WAVERLEY

Some time during 1888, work was started on a long tunnel [illegible] barrel quartz on Laidlaw hill. The tunnel was started [illegible] water level close to the road leading to Truro and was carried eastward. Work on this tunnel was carried on in a more or less desultory fashion [illegible] several years, but on November 14, 1892, the barrel quartz [illegible] after the tunnel had been driven 610 feet. It was, however, several [illegible] after this before mining on the barrel quartz was resumed [illegible] degree of activity.

In 1889, Mr. Hayward continued enlarging the 360 foot shaft [illegible] cutting and doing other development work on American hill for the Lake View Mining Co., Ltd. Only a small amount of gold was reported [illegible] this year and most of this was produced by the Palgrave Gold Mining [illegible]

In 1890, the Lake View Mining Company's property was equipped with an expensive plant including a 30-stamp mill and eight Frue vanners, and 349 ounces 15 pennyweights of gold was extracted from 4,011 tons of ore. Early in 1891, it is said, the Company concluded that the ore was too low grade to pay and work ceased though the mine was kept [illegible] later was leased to A. A. Hayward, and during this year [illegible] gold was extracted from 1,271 tons of ore. In 1892, however, Mr. Hayward ceased work and the mine was let to tributers.

In 1890, the Palgrave Gold Mining Company reported some gold [illegible] the Union lode, but next to the Lake View Mining Co., Ltd., the principal producer was the Windsor Junction Gold Mining Company. This Company worked on the old DeWolfe property under the management of Capt. McDuff, made small returns in 1891 and 1892, but closed down early in the latter year.

In 1891, the Sophia Mining Company did some work on the Tudor and Nigger lodes of the old Parkner property, but did not meet with much success. This year saw the incorporation of a company which once more made Waverley one of the more important gold-producing districts of the Province—the West Waverley Gold Company. This Company acquired the old McClure property and early in 1892 had a 10-stamp mill at work. This mine, under the management of J. E. Hardman, made steady returns, and in 1893 ten more stamps were added to the mill. During the latter year sixty men under the management of H. F. Putner, continued cross-cutting and stoping the Dominion and Tudor leads. The property passed into the hands of the Tudor Gold Mining Co., Ltd., in 1894, and operations continued. In 1895 forty-five men were employed under the management of J. E. Hardman. This year the shaft on the Dominion lead was 500 feet deep and the Tudor, Graham, and Hardy leads were [illegible] at a depth of 225 feet. This Company made returns in 1896, but in 1897 returns were made by tributers only.

Later on, the mine on Laidlaw hill came in for some attention and in 1895 some work was done by B. C. Wilson. During 1898 and 1899, the Tunnel Mining Company was the chief producer of the district. In the latter year, J. G. McNulty had sixty men employed here, chiefly on the north limb of the anticline. In 1900, this mine was worked by the Waverley Gold Mining Company—J. G. McNulty, manager—and the work was done chiefly on the north limb of the anticline, where four levels were driven, of which the upper two were drained by the long tunnel [illegible] to the west. The ore was raised through shafts and stoping was vigorous. During this year a 60-stamp mill was erected and four Wilfley tables were put in to save the auriferous sulphides. The whole plant, including mill, concentrators, air compressor, and electric light plant, was run by water-power, brought from Fall river, [illegible] miles distant, by ditch and flume. In 1901, McNulty had one hundred and sixty men on the pay-list, the main shaft had reached a depth of [illegible] 500 feet, a fifth level was started, driving and stoping were carried on, and enough ore taken out to supply work for twenty to thirty of the sixty stamps and two of the four Wilfley tables. In 1902, E. H. Emerson was manager at this mine and had seventy men employed and vigorous operations were carried on. Unfortunately work ceased during a part of the summer owing to lack of available water-power. Work was resumed later and continued into the next year, when the mine was again closed through lack of power. Operations at this mine during the years 1901-1903, inclusive, again placed Waverley among the more important producing districts of the Province.

and during these three years over 7,700 ounces of gold was recovered from this one property, from about 28,000 tons of ore.

Other work was done during these years, but little was produced besides what the Waverley Gold Mining Company reported. In 1901, W. Temple, working on some areas adjoining the property of the Waverley Gold Mining Company, sank a shaft 165 feet deep and at a depth of 145 feet cut the barrel quartz vein. The next year he drove a level on the vein about 168 feet long, and in 1903, this property was worked under the same management as that of the Waverley Gold Mining Company. Some returns were also made in 1901 and 1903 by the Tudor Gold Mining Company.

In 1901, a cyanide plant was erected by Sydney Smith, but after treating 2,000 tons of tailings it was shut down, not enough gold being extracted to make it pay.

General Development.

The extent of operations is well indicated on the published plan for which the survey was made in 1898. In many veins, as the Brodie, North Taylor, and a portion of the Tudor, the ore has been reached by a great many shafts, whereas in other veins, as the Dominion, and No. 6, the ore has been removed to a great extent by means of one deep shaft on each. There has been a small amount of cross-cutting, and on American hill a cross-cut driven north from the 340 foot level of No. 6 was used in the removal of ore from the Twin Taylor and North Taylor lying to the north. On the West Waverley property a cross-cut extending 729 feet south from the Brodie lead was driven at a depth of 225 feet and cut ten lodes, two of which do not outcrop on the surface.

The Barrel lead was for some time removed by open-cut, then, as has already been pointed out, a tunnel 670 feet long was driven from the level of Lake Charles to cut the apex of the saddle and a rise was made on the vein. Levels were driven north and south, but the main operations were limited to the north leg of the saddle. On this leg a shaft was sunk on an inclination of 53° to a depth of 465 feet. From this shaft five levels have been run, the first two a good distance to the east, and on the west side as far as the apex, and also a considerable distance around on the south leg, while levels 3, 4, and 5 are carried to the west about to the apex of the fold. From a shaft sunk on the south leg and known as No 2 South, as well as from No. 2 North, sunk on the north leg 300 feet east of the main shaft, some levels were driven, but the greater proportion of the work was done from the main shaft.

There is still room for much exploratory work in this district. Surface prospecting might be directed to that portion of the district lying between the Lake View mine and the barrel quartz vein on Laidlaw hill.

Then as regards underground explorations, Faribault, in a report to the Deputy Commissioner of Mines, Halifax, dated July 28, 1909, has recommended cross-cutting towards the anticline from deep shafts on the north limit of the zone of enrichment with the driving of levels on the most likely veins in order to reach the pay-shoots. This, it is thought, would open up portions of veins lying in the zone of enrichment. The following two suggestions are made:—

(1) From the bottom of the Hardman shaft on the Dominion lead, reported to be 628 feet deep, a cross-cut should be driven 500 or 600 feet south. This would cut the Hardy, Graham, Slate, McHenry, and Sonata leads already known on this property, also leads outcropping between the McHenry and the anticline on the Lake View property on the eastern side of the Muddy Pond fault, as well as other underlying veins not exposed here.

(2) The main shaft on No. 6 on the Lake View property, now 340 feet deep, should be sunk 90 feet deeper to the Muddy Pond fault, which dips east at an angle of 40° and runs about at right angles to the strata. A cross-cut driven along this fault north 125 feet and south 500 feet would intersect the veins lying on each side of the fault. It is reported that no trouble has been experienced from water in the cross-cut already driven 230 feet along this fault at the 340 foot level, and there is still less likelihood of trouble at the 430 foot level. The advantage of following the fault will be more apparent when it is remembered that the displacement of the leads 100 feet to the north on the east side of the fault is not due to a simple horizontal movement, but to an upward and westward movement

9869 p. 256

Lake View gold mine, Waverley.

1
1
1
1
1
1
1
1
18
18
18
18
18
18
18
18
18
18
18
18
18
18
18
18
18
18
189
189
189
189
189
189
189
189
190
190
190
1904
190

of the eastern block relative to the western block, a reversed fault. This explains why the apparent horizontal displacement of the leads and of the anticlinal axes is in opposite directions, as shown on the plan. The extent of the movement is not known and no calculation can be made of the displacement of the pay-shoots, but they are found at a higher level on the east side than on the west. More definite ideas as to the extent of movement may possibly be obtained from observations in the cross-cut along the fault.

The Dominion lead lying 25 feet north of No. 6 has been worked for a length of 230 feet on the 340 foot level to the western boundary of the Lake View property, and it is probable that it will be found to carry pay-ore at the 430 foot level. At this level the Dominion and all other veins on the west side of the fault would have a length of about 370 feet to the western boundary of the Lake View property.

There is also room for explorations in other parts of the district. The ore-shoots in the Tudor and neighbouring leads may extend farther west than they were worked in the early days. Although diamond drilling on the apex of the fold on Laidlaw hill gave no very encouraging results it may be that a cross-cut driven from the bottom of the main shaft on the Barrel quartz lead towards the anticline would cut some paying veins.

Production.

Year.	Total ounces of gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1862	1,507	0	0	3,741	0	8	1
1863	2,380	6	3	6,755	0	7	1
1864	6,410	4	22	9,238	0	13	23
1865	14,404	4	9	12,518	1	3	0
1866	8,612	17	11	16,750	0	10	6
1867	3,942	5	2	10,510	0	7	12
1868	2,387	8	22	6,372	0	7	11
1869	1,791	14	10	3,915	0	8	3
1870	811	3	21	2,619	0	6	4
1871	1,427	18	12	2,772	0	10	6
1872	1,047	17	0	1,761	0	11	21
1873	1,009	0	0	2,013	0	10	0
1874	1,553	12	15	1,682	0	18	11
1875	1,740	1	0	1,313	1	6	12
1876	1,539	7	0	1,661	0	18	12
1877	866	18	10	1,422	0	12	4
1878	498	12	8	1,197	0	8	8
1879	116	11	1	442	0	5	7
1880	156	13	15	346	0	9	1
1881	374	0	0	535	0	14	0
1882	231	7	5	554	0	8	14
1883	46	3	0	96	0	8	12
1884	1	7	0	10	1	7	0
1885	170	2	6	223	0	15	2
1886	329	2	0	508	0	12	22
1888	232	9	10	619	0	7	12
1890	482	12	0	3,509	0	2	18
1891	602	4	0	1,611	0	7	11
1892	9,006	11	0(?)	3,154	0	5	17
1893 9 mos. ending Sept. 30.	1,529	6	0	5,509	0	5	13
1894 Year ending Sept. 30..	1,860	1	0	9,310	0	3	23
1895	1,540	2	0	6,315	0	4	21
1896	534	17	12	2,560	0	4	4
1897	461	8	0	806	0	13	7
1898	504	13	11	807	0	12	12
1899	75	7	12	181	0	8	7
1901	2,963	4	14	8,908	0	6	12
1902	3,049	14	0	11,789	0	4	20
1903	1,853	14	16	7,795	0	4	18
1904	No crushing.						
1905	2	4	15				

WESTFIELD.

Westfield is situated in the northeastern part of Queens county, about 4 miles northeast of Caledonia, the terminus of the Caledonia branch of the Halifax and Southwestern railway.

[1] At this place there are a number of interbedded quartz veins lying in the upper portion of the Halifax formation. The rocks are black slates with a few beds of rather siliceous material. The veins consist of quartz 'reefs' 20 to 30 feet thick, and both the veins and the rocks carry more or less pyrite and mispickel.

[2] A discovery was reported from Westfield in 1888, and it is reported that a shaft was sunk 40 feet deep on the Jumbo lead, which is 20 to 75 feet wide. This is the only lead worked. Some further work was done in 1895, and the shaft is said to have been continued to a depth of 70 feet The vein attracted more attention on account of its size than on account of its gold content.

WHITEBURN.

Location.

Whiteburn gold district is situated in the northwestern part of Queens county, 6 miles southwest of Caledonia, the terminus of the Halifax and Southwestern railway.

Geology.

[3] This district lies in the centre of an elliptical area of quartzite rocks of the Goldenville formation about 8 miles long by 3 miles wide and extending from Cameron lake to the head of Lake Rossignol. At Whiteburn, the axis of the anticline runs northeast and the strata dip at low angles, 40° to 50° on the north limb and 10° on the south limb. The district is characterized by the small amount of slate interbedded with the quartzite. The absence of these slate belts makes it necessary to pursue mining operations in the quartzite and the cost of mining is thus much increased. On the north limb of the anticline occurs a subordinate fold with axis probably running northeast from the axis of the main fold, and it is on this subordinate fold that much of the mining has been done. There is also a subordinate fold on the south limb of the anticline, which also seems to have favoured ore deposition.

Character of the Deposits.

The deposits lie on the eastern end of the dome, and the area opened extends 1½ miles east and west and one mile north and south. The most important are found on the subordinate fold on the north limb, and are interbedded. The following leads, given in order from south to north, are the principal ones: Gammon (4 inches), South (5 inches), Cellar (5 inches), Rusty (3 inches), Battery (3 inches), North, and Dunbrack. West of these a number of leads have been worked on the old Rossignol property. The Corrigan lead on the Banks property lies on a subordinate fold in the southwestern part of the district. It is 1 to 5 inches thick, runs S. 5° E. (magnetic) for some distance and then turns southeast, and on the apex of the flexure it carries rolls dipping southwest at a low angle.

History.

Whiteburn is one of the more recently discovered gold districts and for a few years assumed considerable importance as a producer, the yield for each year from 1887 to 1889 inclusive being in the neighbourhood of 2,500 ounces; while for 1890 and 1891 it was a little over 800 ounces.

Prospecting began here in 1884 and the next year mining operations were carried on. The Messrs. McGuire opened a lead to a depth of 20 feet and took out some quartz yielding 17 ounces per ton. Arrangements were

---

[1] Ann. Rep. eGol. Sur., Can., IX, 138 M.
[2] Report of the Department of Mines, Nova Scotia, 1888.
[3] Ann. Rep. Geol. Sur., Can., IX, 138 M.

made to erect a stamp mill. Prospecting was done north of McGuire's property by Messrs. Hall, Owen, Barss, Cole, Telfer, and Annand and about ten veins were opened varying from 4 to 12 inches in width. Trial crushing from some of the larger veins gave a yield of 3 ounces per ton.

During the early years of Whiteburn's history transfers of property were frequently made and from the available information it is almost impossible to follow the operations of the different companies or to know the exact location of their works. In 1886 prospecting was continued and a number of new leads were opened. The McGuire Bros. opened another lead on their property and a new lead discovered west of McBride hill turned out some good looking quartz. Two new mills were erected; one on the Parker-Douglas property and one, known as the Foster mill, on the Parker, Cole, and Wile property. During 1887 three mines and mills were at work, the success of the work on the McGuire lead stimulating effort on their properties. In 1888 two veins on the McGuire property were successfully mined under the management of R. R. McLeod. Operations were also conducted by Mr. Graves on the property to the north, and the continuation of the north McGuire vein was cut by a vertical shaft and worked for a while. This is the property formerly known as the Parker-Douglas property, and was probably owned this year by the Whiteburn Mining Company, a Company that returned half the production of the district, and continued to make returns for the two succeeding years. The Cushing property was idle during 1888, but some finds were reported from near Corrigan lake. The McGuire mine yielded 1,028 ounces from 290 tons of quartz in 1889, but closed down at the end of the year. The Whiteburn Mining Company also carried on important operations, worked several veins, and reported 1,412 ounces of gold from 1,022 tons of ore.

This mine was also closed and during the first part of 1890 the district was almost idle. A number of transfers of property were made this year. The old Cushing property was acquired by the Rossignol Mining Company and the work was started late in the year. The McGuire property was reopened by the Queens County Mining Company, and the Whiteburn Mining Company's mine was reopened under new management, the latter doing the most extensive mining during the year. This Company also made the largest returns in 1891, during which year small returns were also made by the Rossignol Mining Company. On the property of the latter Company some twenty men were employed, and about forty men were engaged in prospecting by the Whiteburn Mining Company under the management of Mr. Partinger.

Except for a little tributing the district was idle during 1892 and no returns were made. The year 1893, however, saw a revival in the industry, and returns of considerable importance were made by the Rossignol Mining Company and Queens County Mining Company, while less important returns were made by J. L. Graves and K. F. Crocker. At the time of the inspector's visit in September this year, the Crocker Mining Company—Kendall F. Crocker, manager—had twenty-five men employed on the old McGuire property, and Alex. Gordon had eight men trenching on the property of the Whiteburn Mining Company.

Since then work has been of a very desultory nature and only small returns have been made. In 1897 a little crushing was done at the Whiteburn mill but the district was generally idle. In 1900, 1901, and 1902, J. W. Lowe made small returns and from 1903 to 1906, inclusive, small returns were made by C. T. Crocker.

General Development.

Little information on this point is available except a few notes got by Faribault in 1903. On the West or old Rossignol property ten leads were worked, several shafts were sunk 100 feet, and one 150 feet. The McGuire North lead was worked on the Crocker property 300 feet deep on the dip and 500 feet in length. The Rusty lead was worked 62 feet in depth and 400 feet in length, the South 200 feet in depth and 1,000 feet in length, and the Gammon 62 feet in depth and 200 feet in length. These notes are not detailed and make no claim to great accuracy.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2000 tons.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1887	2,305	12	13	1094	2	[illegible]	
1888	2,799	4	8	1292	2		[illegible]
1889	2,440	15	18	1639	1	9	1[illegible]
1890	840	3	1	960	0	17	
1891	813	12	2	803	1	0	
1893, 9 mos. ending Sept. 30	448	11	0	649	0	13	[illegible]
1894, Year ending Sept. 30..	336	8	0	555	0	12	

WINE HARBOUR.

Location.

Wine Harbour gold district is situated in Guysborough county, on harbour of the same name, so-called because a vessel once wrecked on t sand which almost closes its entrance was laden with wine. It is abo 12 miles southeast of Sherbrooke and 47 miles by post-road from An gonish, and, although on the Atlantic coast, it is 7 miles from the neare steamboat landing at Sonora. Coal, however, can be landed in the d trict by schooner.

Geology.

The Goldenville formation is here folded into two anticlines verging towards the west. On account of the heavy drift the exact l tion of the north anticline and the syncline has not been as accurat determined as could be desired.

[1] The northern anticline passes through area 388, block 6, immediat south of Rocky point on Indian harbour, where the strata dip at angles increasing to 75° north at Fleming cliff, and to 45° south. T anticline runs N. 74° W. and merges into the southern fold seve hundred feet north of the Major Norton workings.

The southern anticline crosses the south end of Barachois pond, ru N. 65° W. under the boulder clay of Rude hill, passes 100 feet south of t old site of the Eureka mill, follows Barachois brook and outcrops at t surface on area 36, block 41, at a distance of 750 feet north of the Ma Norton workings, beyond which it runs beneath drift N. 63° W., pas a short distance north of the Smelt Brook cove of Wine harbour a past the south end of Lake Cooper, where it is well exposed. The t plunges east and west at low angles and the centre of the dome li the west end of the district, although on account of the drift it has been located. The strata of the north limb dip north 50° to 60°, whil the south limb the dip increases abruptly to 70°, then gradually to 8

The intervening syncline runs west from the north end of Bara pond, passes 150 feet north of the old site of the Eureka mill, and is posed pitching east at a low angle on area 140, block 6.

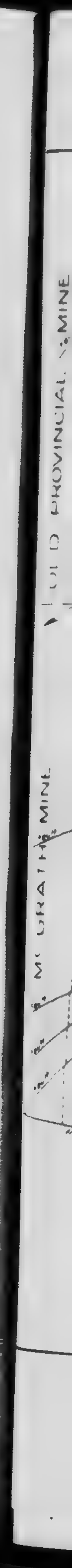
The south anticline may be considered the main anticline of district, and the north fold as a subordinate crumple on its north l

The eastern part of the district has suffered little from faulting, in the southwestern part a series of faults radiates towards the sout southeast crossing the Major Norton, Creighton, Hog, Haliday, D barres, Washington, Air-shaft, Plough, and Caledonia leads and incre the expense and difficulty of recovering the ore from this zone of en ment. The largest of these has been shown by Mr. McGrath's develop work on the Plough lead to have at this point a horizontal displace 130 feet to the north and a down-throw of 57 feet on the east side

[1] Faribault, Geol. Sur., Can., XV, 415 A

Open cut on the Plough lead, Wine Harbour.

9869—p. 260


OLD PROVINCIAL MINE
M^c GRATH MINE

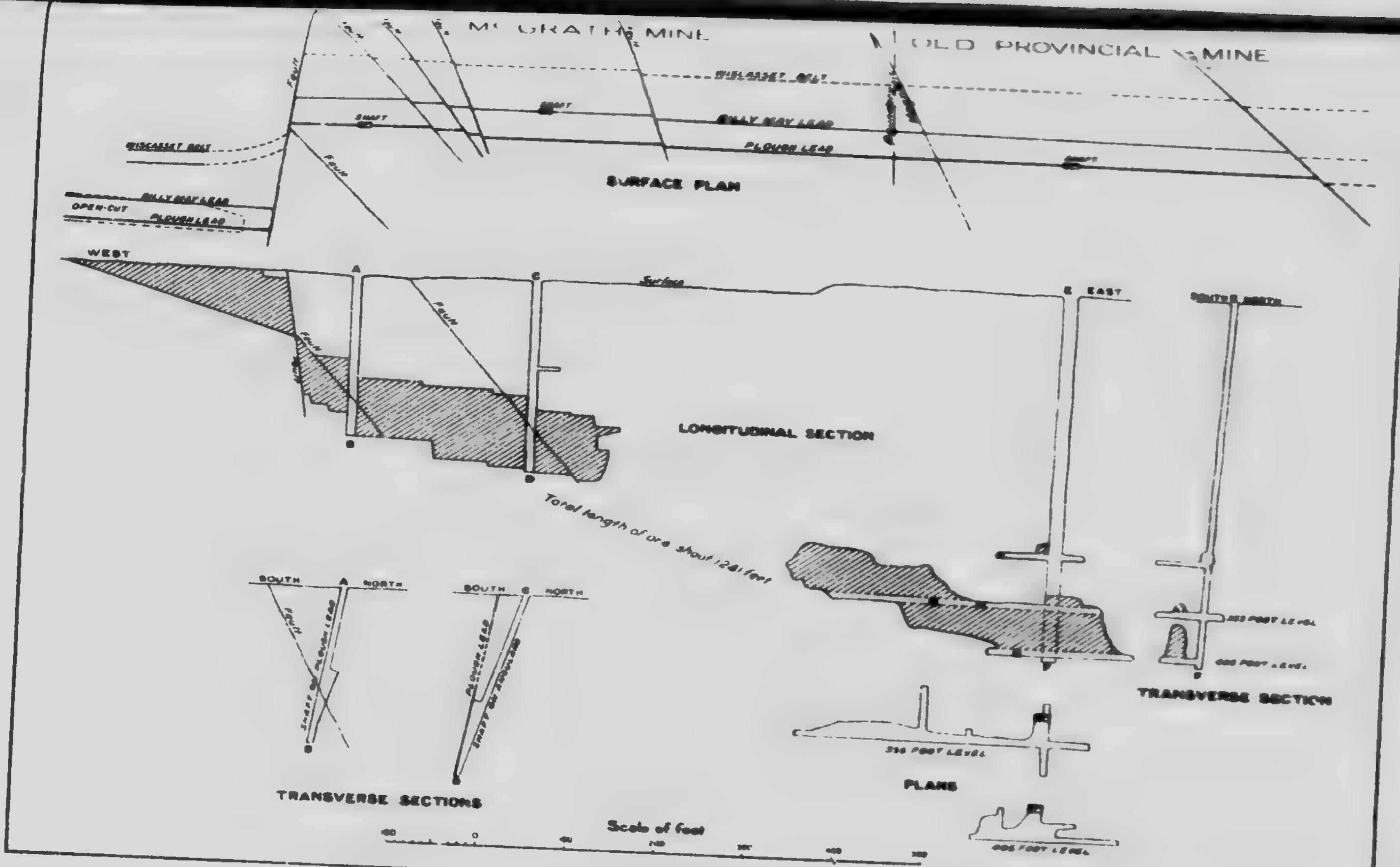


Fig. 19—WORKINGS ON THE PAY-SHOOT OF THE PLOUGH LEAD

WINE HARBOUR

Compiled by E. R. Faribault

To accompany Memoir No. 20

Character of the Deposits.

The veins are of the interbedded class. A [illegible] the shore of Indian harbour, 800 feet north of R[illegible] been developed, and on area 140, block [illegible] developed quartz rolls in slate was uncovered in the [illegible] these exceptions all the veins of the [illegible] f the south anticline [illegible] the south limb.

There are three well-defined sections in this district in which active mining operations have been conducted, separated by [illegible] that have as yet proved unproductive. Further exploration may nevertheless prove these auriferous, and they with the developed parts of the district may make one long continuous pay zone [illegible] on the anticlinal axis as it extends towards the southwest.

At the Barachois mine, at the eastern end of the district a zone of auriferous veins lies between 200 and 300 [illegible] south of the anticline [illegible] pay-shoots dipping east have been profitably worked on the Romkey [illegible] and Hamilton leads. The pay-shoots on the Romkey were worked 100 feet in length and 200 feet in depth.

To the west of this mine lies an undeveloped section and at a distance of 2,500 feet west and 500 feet south of the anticline is another productive section in which the Charlotte and Eureka leads have been worked, the latter for a length of 500 feet and a depth of 210 feet.

West of the Eureka mine succeeds 2,250 feet of drift-covered and undeveloped ground, succeeded by a wide zone of productive veins with pay-shoots dipping east, including the Hattie-Mitchell, Desbarres, Plough, and Caledonia. On the Hattie-Mitchell lying 1,000 feet south of the anticline a rich pay-shoot dipping east was worked 800 feet in length and 240 feet in depth, and 150 feet farther south the Desbarres or Middle lead was worked 800 feet in length and 80 feet in depth. On the Plough lead belt a pay-shoot of quartz 18 feet wide and dipping east 16° was worked across three properties for a length of 1,200 feet and a maximum depth of 105 feet. On the Caledonia a very rich and regular pay-shoot dipping east 26° has been worked for a length of 500 feet and a depth of 175 feet to a small fault, beyond which it has not yet been found. The Wiscassett and Washington belts have been worked respectively 375 and 250 feet in length and 65 and 75 feet in depth. The Moore lead has also proved rich and has been worked 400 feet in length and 190 feet in depth. It is cut at the western end of the works by a left-hand fault running northeast. Several very large belts of low grade ore have been developed to the south of the Moore lead.

The pay-shoot of the Plough lead belt is formed by numerous quartz angulars dipping south into the belt. These angulars appear to extend to the southeast and northwest across the formation and constitute a zone of special enrichment on the Moore, Caledonia, Plough, Wiscassett, Washington, McKenzie, Gillis, and Mundic leads. The Plough lead belt was so named, it is said, because the first evidence of gold at this point was detected in a furrow by a man who was ploughing here. Its hanging wall is smooth and clearly defined throughout all the workings, and is closely followed by a small but persistent vein called the Little South lead, varying from ¼ inch in thickness, and enriched at its intersection with the angulars from the north.

History.

Regarding the discovery of gold at Wine Harbour, the Chief Gold Commissioner says: 'Gold was first discovered in this district by Joseph Smith, in the latter part of July, 1860, at or near the Barachois, on the southwest side of Indian Harbour, at the point where the Barachois lead touches the shore, at which place he found a few small specks of gold in the sand. In the latter part of the month of July in the following year, while prospecting on the northeastern shore of Wine harbour, he found a small piece of gold-gearing quartz in front of what was allotted 'to him as his free claim which lead to the discovery of the Smith lead.' This is probably the one indicated on the plan as the Caledonia. Quite a little alluvial gold was recovered in the early days, but it was insignificant in comparison with the amount recovered by lode mining.

After the discovery of auriferous quartz in 1861, prospectors flocked to the district and there were two hundred men at work on September 26, when the government took formal possession and placed a deputy surveyor in charge. In 1862, seven leads had proved auriferous, the Smith, Middle, Major Norton, Barachois, Halliday, Wiscassett, and Gillespie leads. The Smith lead had yielded the largest quantity of gold, the richest quartz being taken out at a depth of 30 feet, where its average yield was 6 ounces per ton; while on the Hattie claim, 5 tons yielded 125 ounces. At a depth of 50 feet the ore averaged about 3 ounces per ton. The Middle lead was considered second in quality and at a depth of 48 feet, which was the depth of the deepest shaft, the ore averaged 2½ ounces per ton. The Major Norton was not found very auriferous; the Barachois had not been thoroughly tested; only two of the four veins in the Halliday lead had been found auriferous, although only two pits had been sunk 15 feet; the Wiscassett had been found to carry 1½ ounces at the bottom of a 30 foot shaft and no sinking had been done on the Gillespie lead. This is probably the lead indicated on the plan as the Moore lead.

Although mining was hampered to a certain extent by the small size of many of the areas, as at Tangier and the Ovens, it became a settled industry in 1863, and operations were so brisk that this district had the distinction of having produced this year a larger amount of gold than any other district in the Province, and the average amount produced per man was second only to that of Sherbrooke. The result of mining operations in 1864 continued to be highly satisfactory, the yield per man being considerably higher than in any other district and the total production for the year being much higher than for any other year in the history of the district. The next three years, however, saw a steady decline and the production fell from over 4,000 ounces in 1864 to 845 ounces in 1867.

In 1866 the principal mining operations were carried on by the Caledonia, the Glenelg, and the Eldorado Companies, and by the Hon. the Attorney General, the Hattie lode being the one most extensively worked. This is now known as the Caledonia lead. Shafts varying from 70 to 183 feet were sunk on it. The areas of the Caledonia and the Glenelg Companies lay adjacent to each other and hoisting and pumping were done at both mines by the engine at the former Company's main shaft. At a depth of 80 feet and at a distance of 70 feet from the 183 foot shaft on the Caledonia areas a cross-cut was driven north 50 feet and south 38 feet but no veins of any value were cut. To the east and on the Hattie lead three shafts were sunk by the Hon. the Attorney General. The Eldorado Company this year started a tunnel from the shore northward to cut the Middle lode which lies some 700 feet north of the Hattie lead, the object being to explore the intervening ground and to provide a means of drainage. Operations were also begun this year at the Barachois and four 40 foot shafts were sunk on a lode 10 to 12 inches thick.

Mining was dull during a part of 1867, but a change in the ownership of some of the properties led to a renewal of activity. Shafts were deepened on the properties formerly owned by the Caledonia and Glenelg Companies, while the Eldorado Company extended its tunnel to a length of 300 feet. At the Barachois, the Orient Company continued two shafts on the Romkey lode to a depth of 90 and 100 feet; 50 feet north a shaft was sunk on another lode, while to the west Messrs. Capel and Pearse sank two shafts on the Romkey lode.

The principal operators during 1868 were the Orient, the Eureka, the Eldorado, and the Provincial Companies. The Orient Company did no very extensive work and suspended operations late in the year. The Eureka Company sank a 30 foot shaft on the McDonald lead, but operations were almost wholly confined to the Eureka lead on which two shafts were sunk 50 and 100 feet and a cross-cut was started to the south. The Provincial Company did some work on the old Caledonia and Glenelg properties, and sank a shaft about 200 yards to the west of the Caledonia shafts on a lead thought to be about 18 feet north of the Hattie lead. At a depth of 30 feet an exploratory cross-cut was started northward. The Eldorado Company in addition to extending the tunnel to a length of 400 feet sank a shaft 150 yards west of the tunnel on what was thought to be the Hattie lead. In addition to the above-mentioned work Mr. McIntosh

directed his attention to sinking on a lode some distance to the west of all these older workings.

In 1869, on the Napier Company's property, which consisted of the old Provincial areas and some adjoining areas, three shafts were sunk, and some cross-cutting and development work was done, while the Eureka Company did considerable stoping and some cross-cutting. In the cross-cut to the south a 5 inch lead was cut and levels were driven on it. On the lode opened by Mr. McIntosh, the Globe Company worked a belt 11 feet wide by an open-cut 120 feet long. Another belt, 16 feet wide, was also worked by open-cut. Both of these belts were also opened by shafts sunk by the Eldorado Company. This Company completed its tunnel and through a 74 foot shaft hoisted ore from the lode cut by the tunnel. Nothing was done this year by the Orient Company.

The year 1870 saw a marked decrease in the amount of work done, but a slight increase in production. The only mines in operation were those of the Eldorado and Globe Companies and both of these companies continued to mine the belt of lodes opened by Mr McIntosh. A width of from 6 to 8 feet was stoped out. At the end of the year work was resumed on the Eureka property on the lode opened by the south cross-cut and carried on during 1871 by the Phoenix Company, who reported 151 ounces of gold from 140 tons of ore. Small returns were made in 1871 by the Provincial mine and the Gladstone Company, but 1,267 ounces out of the 1,438 ounces produced by the district were returned by the Eldorado Company who crushed 1,786 tons taken from the belt of lodes, worked the preceding year. On this a new shaft was sunk.

After doing development work on the Eureka and Charlotte lodes the Phoenix Company suspended operations early in 1872. Work was, however, vigorously carried on by the 'English Company'—Mr. Sprague manager—on the Eldorado property, with very gratifying results. The Plough lead was mined and ore was hoisted through a 110 foot shaft from a stope carried down 13 feet wide and 100 feet long. Work was also resumed on the old Eldorado tunnel with the intention of draining the leads that lie within 560 feet of the Desbarres lead. This tunnel was continued as far as the Mitchell lead in 1873. The Plough lead gave very satisfactory returns during the greater part of the year, but it was found to be faulted at the east and as it could not be picked up again the Eldorado Company extended the shaft in depth. Some work was done on the Norton and Hattie leads, and Mr. McIntosh opened the western extension of the Plough lead, but found that it was not rich enough to be profitably worked. This year the main lead at the Barachois was reopened and worked.

In 1874, the Eldorado Company suspended operations, for on sinking 20 feet below the 130 foot level the lead pinched to less than 2 inches and carried no gold while at the east it was cut off by a fault, and pinched and became barren towards the west. At the Barachois the thick lead was abandoned and some work was done on a lead 25 feet to the south. A little work was also done on the Major Norton.

After this followed a long period during which little mining was done except by tributers, and for over 20 years the production was very low, there being many years in which little or no gold was reported.

In 1875, work was suspended at the Barachois and about the only mining done was on the Plough lead, where tributers removed the roof of the belt and the parts that had been left to support the walls, and on the Mitchell lead, where blocks of the vein left between adjoining claims were removed. The production of 1876 rose to over 1,200 ounces, but most of this came from branches and spurs of the Plough lead. Some tributing was done on Judge Henry's property on the Moore lead, areas 15 and 27, block D, and on the Middle and Mitchell leads. Work was continued on the Moore and Mitchell leads in 1877 and some mining was done at the Barachois.

The history of this district can be little more than a record of the leads worked during the different years, as no mining of any great extent was undertaken for two decades. In 1878, the Plough lead was partly pumped out, there was some tributing, and a little work was done on the Mitchell lead. The next year work continued on the latter lode and several crushings were then taken from the Hattie lode and the Wiscassett belt. In 1880, Mr. W May removed a little ore from the Plough lead and

prospecting was carried on, but only 61 ounces of gold was returned. Work was started on the Henry mine and this was practically the only one worked during the following year, when 79 ounces were recovered. Operations at this mine were, however, suspended in the spring of 1882, and for a few years the district was idle. In 1885, Mr. Colchester worked a lead that yielded 15 pennyweights per ton. In 1887, the mill on the Judge Henry property was taken down and rebuilt on a new site preparatory to reopening the mines the next year, and in 1888 mining was carried on to a limited extent by the Napier Mining Company, who returned a yield of 239 ounces from 324 tons. During 1888 some time was spent also in searching for the eastern extension of the Plough lead. In 1889, the Napier Mining Company continued working on a small scale, but the principal operations were on the Middle lead where the ore was crushed at a new mill erected to replace the old Eldorado mill. In 1890 the Napier Mining Co. recovered 73 ounces from 278 tons, and the New Eldorado, 590 ounces from 1,145 tons. In August, 1891, R. McNaughton worked the Middle lead leased from Mr. Harding and associates, and started work on the Caledonia, but operations were suspended later in the year. In 1892, little gold was recovered, but there were sixteen men at work in September under the management of H. Harding. Returns were made by McNaughton in 1893.

Although no returns were made in 1894, the Eureka lead was reopened by the Eureka Gold Mining Co., under the management of A. McQuarrie; it was, however, allowed to fill again in the autumn. There was also a little prospecting in the district. The Wine Harbour Gold Mining Company was incorporated this year and the following year a search was made for the eastern part of the Plough lead. Under the management of George Stuart the extent of the displacement was determined and a shaft started east of the fault to cut the Plough lead. In 1895, the Barachois Gold Mining Company, under the management of M. McGrath, did some work on the Romkey and Twin leads, and continued operations for two or three years. In 1896, twenty-three men were employed under the management of Richard Sherman, and ore from the Romkey lead was crushed at the 10-stamp mill. The next year Martin O'Shaughnessy was manager and work was continued on the Romkey lead, although preparations were made to reopen the Twin lead. In 1897, the Napier Gold Mining Company also did a little work under the management of H. T. Harding, and crushed considerable ore in 1898.

In 1899, the production of the district was greatly increased, being over 1,500 ounces, of which the greater proportion was recovered by the Guysborough Gold Mining Company, Ltd. Some work was done by the Napier Gold Mining Company, under the management of David Steele. Operations were also carried on at the Wiscassett mine and on the Plough lead by the Plough Lead Gold Mining Company—Mr. McGrath, manager. The shaft was 110 feet deep and levels were driven east and west 60 and 70 feet respectively. The most extensive operations were those of the Guysborough Gold Mining Company, Ltd., on the old Eureka property. Forty men were employed under the management of E. A. Mortimer; an air compressor, a modern 10-stamp mill, and a Wilfley concentrator had been erected and ore was hoisted by three shafts, two of which had been sunk some years previously. A cyanide plant was erected in this district on Coopers brook by Messrs. Wethersole and Russel for the treatment of tailings.

The work at the Eureka mine ceased in March, 1900, and the mine remained idle until June, when it was taken over by the owners of the Plough Lead mine and operated. The Plough Lead Mining Company extended the shaft on the Plough lead to a depth of 177 feet and stoped from the 20 foot belt, of which 75 per cent was milled with the result that by far the largest returns of the district for this year were made by this Company. In sinking the shaft the old fault was encountered and it was determined to sink a new shaft 175 feet farther east.

In October, 1899, McNaughton's shaft at the old Middle Lead mine was reopened by M. L. Pratt & Co., under the management of R. S. Irwin, and in 1900, a considerable amount of low-grade ore was crushed at a new 5-stamp mill. In 1901 this Company continued operations at three different points on the old Provincial property under the management of Mr

Conroy. A shaft 13 feet by 4 feet inside timber was started 600 or 700 feet east of the Plough Lead works with a view to tapping the ore body of the Plough lead at a depth of over 200 feet. Old workings on the Caledonia belt were reopened and some levels and a cross-cut were driven. In addition to this a shaft was sunk 50 feet deep at a point north of the road and near the schoolhouse and cross-cuts were driven to the Hattie and Mitchell leads. This year the Plough Lead Mining Company J.S. Lowe, general manager had thirty-five men employed and stoping was carried eastward on the pay-shoot, which dipped 18°. The new shaft to the east was started and sunk to a depth of 90 feet. The Eureka lead, half a mile to the east, was also opened by a new shaft.

The principal production of 1902 was made by the Pl ugh Lead Mining Company, M. McGrath, manager. The new shaft at the east was connected with the underground workings from the west and stoping was active, the ore being crushed at a 15-stamp mill. Work was also carried on by a company incorporated this year, the Old Provincial Mining Company M. L. Pratt, president, S. R. H akes, general manager. E. Conroy had charge of the work near the Plough lead and George Hirschfield of the Caledonia mine. At the former the shaft was continued to a depth of 300 feet and some levels and cross-cuts were driven, while at the latter some levels were driven. Work was resumed on the old Napier property by R. S. Irving for L. W. Getchell and T. R Gue. An old shaft on the Moore lead was cleaned out, and at a depth of 175 feet a cross-cut was started to the south. The Napier mill of 13 stamps and the old plant were in use.

In 1903, the Plough Lead Mining Company followed the ore 86 feet east of the east shaft, removing it by underhand stoping. The Old Provincial Mining Company deepened the shaft sunk for the Plough lead to 350 feet and did some cross-cutting. At the bottom a cross-cut driven to the south 21 feet struck what was thought to be a continuation of the Plough lead and levels were driven on it east and west. Work was also continued at the Caledonia mine and the ore was passed through a 15-stamp mill and a Wilfley concentrator. The old Napier property was worked under the direction of L. W. Getchell and produced about 230 ounces.

In 1904, stoping was continued by the Plough Lead Mining Company, but this was the last year in which returns were made. The Old Provincial Mining Company suspended operations at the Caledonia mine but continued work at the Plough Lead shaft. This shaft was deepened to about 400 feet, cross-cuts and levels were driven, and some ore stoped out. The Napier mine was kept unwatered and a little work was done.

In 1905, the Old Provincial Mining Company -S. R. Heakes, manager— was the only one to make returns. The Little South lead, which formed the hanging-wall of the belt known as the Plough lead, was driven on 95 feet east and 107 feet west on the 400 foot level. The mine was closed in August, 1905, and remained closed until the following March, when it was reopened by the Wine Harbour Mining Company. Forty men were employed in 1906 and ore was removed from the 300 and 350 foot levels west and the 400 foot level east. The same Company was at work here in 1907 under the management of J. Owen James, and work was almost wholly confined to the 300 and 350 foot levels west, 6,333 tons mined and crushed yielding 1,017 ounces. Mining operations were discontinued in September.

General Development.

A fair idea of the extent to which operations were carried on here can be had from the published plan for which the survey was made in 1902, from the notes on the pay-shoots given under the section dealing with the ore deposits, and incidentally from notes on the history of the district The exact degree of development in individual mines is, however, difficult to learn.

Regarding future explorations the attention of the prospector might be called to several undeveloped veins lying to the north and south of the Twin, Romkey, and Hamilton leads. Then too the unproductive sections already pointed out as lying between the three productive portions of the district should claim some attention. Rich drift has been found immedi-

ately to the north of the Moore lead, and between the Eureka and the Barachois properties. As the direction of glaciation was here S. 9° E., it is more than likely that the extraordinarily rich drift found along the shore at Doody head came from the latter portion of the district.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs.		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1862	1,688	0	0	835	2	0	10
1863	3,718	2	19	3,644	1	0	10
1864	4,033	3	7	4,136	0	19	12
1865	2,200	5	14	3,833	0	11	11
1866	1,012	8	4	1,881	0	10	18
1867	845	18	14	1,670	0	10	3
1868	1,248	6	3	2,938	0	8	12
1869	719	8	19	2,726	0	5	6
1870	914	15	14	2,356	0	7	17
1871	1,538	6	16	2,927	0	10	4
1872	2,572	10	18	2,305	1	2	7
1873	2,000	0	3	2,267	0	17	15
1874	623	11	6	1,193	0	10	14
1875	495	11	22	1,140	0	8	15
1876	1,217	19	7	1,929	0	12	15
1877	580	14	3	1,068	0	10	21
1878	492	13	12	814	0	12	2
1879	427	5	6	424	1	0	0
1880	61	12	0	161	0	7	10
1881	795	14	0	552	1	8	20
1882	91	9	0	145	0	12	13
1888	239	2	0	324	0	14	18
1889	413	18	6	707	0	11	17
1891	698	9	0	1,823	0	7	15
1896	501	2	6	913	0	10	2
1897	318	3	2	611	0	10	9
1898	113	5	17	637	0	3	13
1899	1,529	17	0	2,031	0	15	1
1900	2,088	17	0	3,691	0	11	7
1901	1,362	4	12	4,196	0	6	12
1902	1,186	2	0	4,187	0	5	16
1903	1,412	8	11	4,048	0	6	23
1904	1,681	3	10	5,133	0	6	13
1905	452	10	0	2,251	0	4	0
1906	413	2	0	858	0	9	16
1907	1,017	17	0	6,333	0	3	5

Prospects.

In addition to the above there a great many other places from which gold discoveries have been reported, and at some points more or less development work has been carried on. There has been a great deal of prospecting throughout the gold fields, especially along the anticlines, and numerous veins have been exposed; for example, along the Tangier-Harrigan Cove anticline veins have been exposed at Quoddy, Port Dufferin, Sheet Harbour, Mushaboom, Taylor bay, and at different places west of Tangier.

The following list is by no means complete, but it gives the names of the most important places at which prospecting has been carried on:—

Barr setlement in Hants county.

Beaver Bank Road.—Auriferous drift has been found along the Shubenacadie-Grand Lake anticline between Sleepy cove and Beaver Bank road and some prospecting has been done on Officer brook and between Golden lake and Sandy lake.

Birch Cove and Prince Lodge.—At Birch cove the Goldenville formation is folded in an anticline plunging southwest at an angle of 25°. A discovery was reported from here in 1868 and prospecting has been carried on at different times. It was reported in 1889 that a 12 inch vein was found that showed gold throughout a length of 100 feet. Some auriferous quartz veins have been prospected also at Prince Lodge a little north of Birch cove.

Black river, Kings county.—A discovery was reported in 1868, and a very little prospecting has been done.

Broad river, 10 or 12 miles west of Liverpool in Queens county; discovery reported in 1888.

Cameron dam and Seventeenmile stream, in the western part of Guysborough county The Cariboo-Cochrane Hill anticline here plunges eastward. Several large veins have been exposed near Cameron dam at the foot of Lower Rocky lake, an expansion of Twentymile stream, East River Sheet harbour, and between Round lake and Seventeenmile stream.

Centry.—[1] 'At Centry, often wrongly called Centre, several large blocks of quartz sprinkled with gold have been found the last few years between Dares lake and the main road leading from Lunenburg to Bridgewater, 3 miles out from the former town, and much prospecting has been done to find the vein in situ, but until now without success. There is very little doubt that this float comes from the anticline passing immediately north of Dares lake, where the quartzites of the lower division have been brought up on a broad elliptical dome, 3 miles long by 1 mile wide. . . . Much prospecting was done by Walter H. Prest to the north of the float, on the south limb of the quartzite dome, and several interbedded veins were discovered, but no gold was found in the veins or drift, showing that the gold-bearing vein is farther south.'

Chezzetcook.—Some quartz veins were prospected a few years ago on the Lawrencetown anticline at Head of Chezzetcook not far from the post-road and a crusher was erected. About 2 miles southwest of here, near Porters lake, a few other quartz veins received some attention.

Clearland.—Near Clearland post-office in the eastern part of Lunenburg county a few quartz veins on the Leipsigate-Gold River anticline have received a little attention and a 22 foot pit was sunk on one that is 2 to 12 inches thick. There has been prospecting along this anticline from the foot of Long lake on Mushamush river to West lake on Martins river.

Cole Harbour.—A few veins were opened at the head of Cole harbour on the western continuation of the Lawrencetown anticline.

Copes dam.—Some prospecting has been done at Copes dam and at Rocky lake on the Moose River-Fifteenmile Stream anticline on each side of the Sheet Harbour road.

Fairview or French Landing.—A cross vein has been prospected about half a mile west of Bedford basin, between Fairview and Rockingham.

Farmville on the New Cornwall road in the eastern part of Lunenburg county. There are a few veins in the slate and a pit has been sunk 40 feet on one.

Gegogan.—There is a dome on the Mooseland-Gegogan anticline, between the mouth of St. Mary river and Gegogan harbour. Rich drift has been found on both sides of Gegogan harbour, but prospecting has not resulted in the discovery of any important veins, and it is believed that the best veins lie in the harbour.

Greenfield in Queens county, discovery reported in 1888.

[1] Summary Report, Geol. Sur., Can., 1907, p. 80.

Halifax city.—The Halifax formation is exposed on the western continuation of the Lawrencetown anticline. Most of the prospecting has been done between Quinpool and Jubilee roads. One trench cut twelve quartz veins varying in width from 1 to 12 inches and some of them were found to be auriferous. Among the veins that have received some attention are: a 3 inch vein near the corner of Oxford street and Quinpool road; a vein between Pepperel and Shirley streets just east of Preston street; 2 inch vein on Louisburg street between Shirley and Linden streets. In a syncline north of the Lawrencetown anticline a vein carrying gold, galena, and zinc blende was found between Lockman and Upper Water streets and south of North street.

Hammond Plains.—This was surveyed in 1863, and in 1868 it was reported as abandoned, not having come up to expectations. It is reported that three veins were opened on the north side of the main road 2½ miles west of English Corner and three shafts were sunk 130, 30, and 15 feet. The veins are 48, 8, and 7 inches wide, lie near the bottom of the Halifax formation, cut the strata at a slight angle, and dip south 75°. Two veins also near the bottom of the Halifax formation and lying 2 miles east of Hammond Plains post-office were tested by shallow pits.

Horne settlement, 2 miles west of Enfield station.—Four or five interbedded auriferous leads have been prospected. They show the corrugated structure, lie in the Goldenville formation on the north limb of the Shubenacadie-Grand Lake anticline, and dip north at high angles.

Indian lake or Fifteenmile lake on East River Sheet harbour, east of Governors lake.—There has been some rich drift found here on the South Branch Musquodoboit anticline, and some prospecting 2 miles farther east on Bottle brook.

Indian lake on the headwaters of Indian river of St. Margaret bay; a little prospecting.

Kearney lake, west of Bedford basin.—The Goldenville formation is exposed in a transverse anticline running N. 28° W. (magnetic) through the middle of Kearney lake. The strata dip at low angles forming a broad dome. Several corrugated interbedded veins have been discovered near the foot of the lake.

Lewis lake.—Several veins showing the corrugated structure and dipping south at a high angle have been found just south of Lewis lake on the Halifax and Windsor road.

Little Liscomb lake, in the northwestern part of Guysborough county. A few auriferous veins apparently on an anticline have been prospected, and a crusher was erected.

Liscomb Mills, at the head of Liscomb harbour in Guysborough county. The Goldenville formation is exposed on the Salmon River anticline plunging to the west. The veins are interbedded and the following have been noted:[1] "Giant Reef," a quartz vein 20 feet wide; a 20 foot belt of slate and quartz showing gold; a 15 foot quartz vein; and a 10 foot belt of slate and quartz. All these dip north 42° and are traceable three-fourths of a mile. There has been prospecting from Liscomb river as far west as Spider lake. A light 5-stamp mill was erected at the saw-mill and a little ore was crushed.

Lindsay lake.—A few interbedded veins have been prospected near Lindsay lake a short distance east of Middle Musquodoboit. Sydney Lindsay erected a 5-stamp mill late in the eighties and tested some leads, and again in 1903, another test was made of one of the leads. A pit was sunk 20 feet on a barrel-quartz vein.

Meagher Grant.—Some prospecting has been done along the Moose River anticline east of Meagher Grant on the Musquodoboit river. Several veins showing corrugations have been discovered and some are auriferous.

Meteghan in Digby county.

O'Brien lake, 4 or 5 miles south of Oldham.—An auriferous vein was found on the west side of the lake.

[1] Rept. Dept. Mines, N.S., 1896, p. 35.

Porter lake.—Some veins have been found on Porter Lake [illegible] the east side of Porter lake and about a mile north of the post [illegible] discovery was reported in 1880, and prospecting has been carried [illegible] different times since then. Some veins have been traced around the ap[illegible] of the anticline and several varying from 1 to 13 inches in width [illegible] been exposed in slate belts in the Goldenville formation on the south [illegible] of the fold. Some of these are auriferous. Some veins have been pr[illegible] pected about a mile east of [illegible] on the south side of Thompson [illegible] Conrod lakes.

Pubnico in the southwestern part of Yarmouth county. A disco[illegible] was reported in 1868, some work was done in 1885, and a test of [illegible] is said to have given 64 ounces.

Queensport, formerly known as Crow harbour, in Guysborough c[illegible] It is reported that an auriferous vein 2½ to 3 inches thick was dis[illegible] in 1898 and some prospecting was done south of Round lake.

Quoddy.—A test of some quartz was made in 1906

Ragged falls, on Twelvemile stream, a branch of East River S[illegible] harbour.—A number of interbedded veins have been prospected on [illegible] south limb of the Moose River-Beaver Dam anticline. The Goldenville [illegible] mation is exposed and the south limb dips north 80°. A number of ve[illegible] have been opened in recent years.

Rhodes Corner, west of Centry, Lunenburg county. Some veins ha[illegible] been prospected on the western plunge of the dome.

Rutherfords Mill, on the Guysborough road, 2 miles northeast [illegible] Fall river. Several veins have been prospected in the Goldenville [illegible] mation.

Shet Harbour, East River and West River.—Several veins have be[illegible] prospected at the mouths of these rivers on the south limb of a subo[illegible] dinate fold on the south limb of the Salmon River anticline. At the [illegible] river prospecting has been recent and there are two shafts on a vein ab[illegible] the bridge. At the West river several veins have been tested at the fa[illegible] above the bridge. Rich drift found on Curry hill has led to much pr[illegible] pecting, but the source has apparently not been found. In tracing [illegible] in this locality account must be taken of the left-hand fault al[illegible] harbour with a displacement along the strike of about a mile.

Somerset, 3 miles south of Italy Cross, a station on the Halif[illegible] and Southwestern railway. Some auriferous boulders from a laminat[illegible] quartz vein 10 inches thick were found in 1905 by Nathaniel Slaughenwhi[illegible] on the north side of the west branch of Petite riviere. Some prospect[illegible] was done in 1906 and 1907, but without success. The Goldenville format[illegible] is exposed in a broad anticline plunging east, and interbedded vein[illegible] would strike north and south. Auriferous boulders were discovered [illegible] mile west by Augustus Reinhardt

Spondo, in Lunenburg county, 7 miles north of Mahone bay [illegible] a mile west of the Woodstock road. A quartz vein 10 feet thick lies on [illegible] apex of an anticline plunging to the east at a low angle. It was [illegible] covered in the early days of gold [illegible] Nova Scotia, but little [illegible] been done. [illegible] is a hole 15 feet deep. A trench cuts a few other [illegible]

Stewart brook, near Country harbour.

Tancook Island. A little work was reported [illegible] 1881. The Golden[illegible] formation is exposed on an [illegible] the north shore [illegible] Southeast cove and forming a dome at Reef point. A few shallow pits [illegible] been sunk on the north shore of the [illegible] veins 3 to 16 inches th[illegible] These veins cross the strata at right angles, dip east 50° to 60°, and app[illegible] to pinch out at no great depth.

Upper New Cornwall in Lunenburg county. Some prospecting [illegible] done in 1899 and 1900 on [illegible] the north shore of Big Mushan[illegible] lake.

Waterville, Kings county. [illegible] a little prospecting was done [illegible] time a few miles south of Waterville station.

West Caledonia, 6 miles west of Caledonia, the terminus of [illegible] branch of the Halifax and Southwestern railway. A [illegible]

was reported in 1888 and there has been quite a little prospecting since. Some rich drift was found and four or five auriferous leads were cut. W. H. Prest did some prospecting here in 1908 and 1909.

Wyses Corner.—A little southeast of Wyses corner, a 30 foot shaft was sunk on a 6 inch vein near the contact of the Halifax and Goldenville formations on Dollar Lake brook. Another vein was found 1½ miles west of Wyses Corner.

York Redoubt.—A few quartz veins were prospected on Sleepy cove of Halifax harbour at the contact of the slate and granite.

Outside the gold-fields.—There has been some prospecting at different times on the mainland outside the gold-fields. [1] Gold was reported many years ago from Cape Porcupine in Antigonish and from Clam Harbour river, about the Middletown road, and some quartz was sent away to be tested, but the results were probably not good. Gold was reported from Sutherland river in 1868. In 1895, there was some prospecting on this river near Greenvale in Pictou county. The rocks consist of slates and quartzites indicated on the map as of Cambro-Silurian age. One quartz vein carrying sulphides was found over 2 feet thick. [2] Gold is said to have been discovered in a quartz vein on Robert Wilson's property, French river, Colchester county, by some men digging a well. The rocks of this locality are talcose micaceous schists and are cut by irregular quartz veins. [4] Near William Warwick's at West Annan one of the irregular deposits of sulphides of iron, copper, and other metals, said to carry gold, exploited from time to time in the Cobequid hills, was developed to some extent' [3] in 1903, and in 1904 the Gilt Edge Gold Mining Company erected some buildings. [4] On Bailey brook south of West River station there has been some prospecting and a shaft was sunk 30 feet in blackish Devonian argillite cut by a band 3 feet thick of clay rock resembling felsite containing graphite, calcite, and pyrite. Some prospecting was also carried on many years ago in Colchester county near where the Florida road crosses the line between Colchester and Cumberland. Other places where there has been some prospecting are McLellan brook, Riversdale, Folly mountain, Tatamagouche mountain, and Irvin lake

Secondary Gold Deposits—Placers.

As has been pointed out, the gold-bearing series has been subjected to long continued erosion, and the upper parts of a great many of the auriferous veins now exposed have been removed. The heavy metals would, no doubt, be concentrated by the selective action of water currents, and in the valleys of some of the rivers that include within their basins one or more gold districts, we might expect to find placers, that could be worked with profit. Unfortunately the Province has been subjected to glaciation, and there has been considerable redistribution of the loose surface material.

Detrital gold deposits may be divided in two classes: (1) ancient and (2) modern, the latter consisting of those which have been resorted within comparatively recent times and are unconsolidated, while the former are of Tertiary or earlier deposition, and are more

[1] Fletcher. Report of Progress, Geol. Sur., Can., 1879-80, 123 F.
[2] Annual Rep. Geol. Sur., Can., Vol. I, 18 A.
[3] Annual Rep. Geol. Sur., Can., XV, 171 AA.
[4] Annual Rep. Geol. Sur., Can., V, 187 P.

or less consolidated. The two classes have been worked in Nova Scotia, the ancient at Gays river, and the modern at the Ovens, and at a few other places.

MODERN PLACERS.

Alluvial gold in modern placers has been found in one or two places in paying quantities, and [1]in nearly all deposits of glacial drift, or boulder clay, on the south coast, more or less gold is found. There is so little, however, that placer mining has never assumed important proportions. How, in his Mineralogy of Nova Scotia, 1868, says he was informed that gold had been washed from the Avon river near Windsor 60 years previously, each man earning 18 pence per day. One of the first to carry on careful investigations was John Campbell of Dartmouth, who was prevented by circumstances from going to the California fields in 1849, and who then conceived the idea of searching for similar geological conditions in his own country. In that year he panned gold from several places along the sea-shore and [2]"continued his investigations with varied success until 1857, when he obtained the co-operation of Mr. R. G. Fraser, the assayer, who made some experiments on the sands of Fort Lawrence, in Halifax harbour, from which they obtained a very good show of gold.

"Encouraged by these results, Mr. Campbell made a report to the government, accompanied by specimens and testimonials from persons who had seen other specimens which he had retained, stating his belief that gold would be found in large quantities. He also made application for a license to prospect and mine on Sable island, where, judging from samples still in his and Mr. Fraser's possession, the sand is highly auriferous. No action was taken upon that report, and though the prospecting license was accorded its terms were so illiberal that Mr. Campbell and his friends had to abandon the project, for which tools, machinery, miners, and a vessel to transport them had already been purchased."

In his report of 1863, Campbell gives the results of certain explorations in the west of Cape Breton, where he discovered gold in the alluvium of many streams, and in such quantities on the

[1] J. Campbell's Report on the Nova Scotia Gold Fields, p. 3, Feb. 25, 1863.

[2] Heatherington, A: "A Practical Guide for Tourists, Miners, and Investors and all Persons Interested in the Development of the Gold Fields of Nova Scotia". 1868.

northeast branch of the Margaree and on Middle river that he expressed the opinion that washing in these streams would prove remunerative. In 1867 an American company constructed sluices near McLennan's bridge on Middle river, and worked during the summer. In 1870 others tested the brooks above McLennan's bridge by means of cradles, sluices, and pans, and in 1902 some Chinamen did some work here, but none of the operations were continued long.

In the early days of gold mining in the Province, some gold was recovered from the alluvium at [1]Isaac Harbour, Wine Harbour, Tangier harbour, Gold River, and the Ovens.

In July, 1861, gold was discovered in the sands of the sea shore at the Ovens, Lunenburg county. These were nearly exhausted by the end of 1862, and it was estimated that altogether 2,000 ounces were produced.

Near Tangier harbour alluvial gold was obtained in 1861 and 1862, and the official returns gave 150 ounces from this source. In the sixties a small lake, called Copper lake, in this district, was drained for the purpose of getting access to the alluvium. Beneath a layer of mud and vegetable matter was found, according to Prof. Silliman, a stratum of glacial drift and tough clay which, when washed, yielded small unrounded nuggets free from trace of mechanical action. Little work was done.

[2]Some prospecting has been done in more recent years on Little Meander river of Hants county. The detritus washed from the gorge it has cut in the anticline of the gold-bearing series, and from the Ardoise gold district, has been deposited in the intervale through which it flows at its junction with the Meander river. It is reported that good wages have been made here. A dam was built on this river below the forks by Van Meter, and there was some sluicing during the summers of 1897 and 1898. In 1899 the Rood brothers did some washing on the Little Meander below the bridge. The results are not known. No gold has been found in the main Meander river above its junction with the Little Meander.

In Ninemile river east of Renfrew, a little washing has been done, as well as in Little Ninemile river, 2 miles north of Ninemile River post-office. North of Wittenburg, 3 or 4 miles east of Gays River

[1] Hunt. Report on the Gold Region of Nova Scotia, Geol. Sur., Can., 1868.
[2] Faribault. Geol. Sur., Can., XII, 182 A.

gold district, some gold was obtained from washings below the meadow, and also 3 miles farther east from the head-waters of St. Andrews river.

Some surface material has been milled in a few of the gold districts. In 1890 several lots of surface material were crushed at Central Rawdon, and in 1892 and 1893 the Oxford Gold Mining Company at Lake Catcha did similar work. More attention has been given to the loose debris at Moose river than in any other district. [1]An attempt was made to wash the alluvium on an extensive scale. A race half a mile long and two flumes, each 200 feet long, were made. A sluice 300 feet long, in which the washing was done, was constructed, but it had not fall enough to clear itself and the undertaking was abandoned. A great deal of the surface detritus was crushed for several years by Mr. Touquoy, and it is stated that during 1895 this yielded one and a half to two ounces per ton.

ANCIENT PLACERS.

Some conglomerate at the base of the Horton series was tested on Fall brook, a fourth of a mile below Windsor reservoir, but the most important ancient placers are those found at the base of the lower Carboniferous formation. [2]In the summer of 1890, great excitement was caused by the reported discovery near Brookfield, far up the Stewiacke river, on the north side, of gold in a whitish-grey flinty conglomerate consisting almost wholly of pebbles and grains of white quartz. These beds underlie the Carboniferous limestone. The conglomerate is said to have given good returns on milling, but careful panning of sand in the beds of streams flowing over it failed to indicate the presence of gold in appreciable quantity. Two samples assayed by Mr. Hoffmann of the Geological Survey gave no trace of gold or silver; these were taken from the vicinity of the barytes mine, and from the brook 300 yards above the Glenbervie mills. Tests subsequently made on a large scale at the mill of one of the gold mines confirmed Mr. Hoffmann's assays. Most of the work done on the ancient placers was at Gays River gold district.

[1] Rept. Dept. Mines, N.S. 1878.
[2] Fletcher. Geol. Sur., Can., V. 61 A.

GAYS RIVER.

Location.

Gays River Gold district lies on Corbett brook in the southwestern part of Colchester county, 7 miles east of Shubenacadie, a station on the Intercolonial railway. From this station it is easily accessible by a good wagon road.

Geology

This district never assumed any importance as a gold producer, but it is of geological interest. This deposit is a good example of a fossil placer deposit, the gold being found in a coarse conglomerate at the very base of the lower Carboniferous formation. [1]This conglomerate, which in some places has a thickness of 30 feet, outcrops in a valley at the base of a ridge which is composed of the slates of the gold-bearing series and rises to about 150 feet above the level of the Carboniferous rocks. This conglomerate, more or less auriferous, has been traced some 4 miles northeast along the base of the ridge, and 2 miles southwest from the district. It is composed of the detritus of the Halifax formation in which the pebbles of slate, and quartz vary much in size and degree of attrition from the numerous well worn pebbles, ranging from the size of a hazel nut to that of an egg, to the much larger fragments showing much less exposure to wave action. There seems to be no uniformity in the arrangement of the pebbles. The matrix is composed of a gritty mixture of quartz, slate and whin. A shaft sunk by the Coldstream Gold Mining Company immediately north of Daniel McDonald's old works and 800 feet from the line of outcrop of the conglomerate, gave the following section of the lower Carboniferous:

[2]Surface drift..	20 feet.
Conglomerate containing gypsum, non-auriferous.	35 "
Coarse sandstone..	2 "
Auriferous irregular conglomerate..	8 "

The conglomerate dips at a low angle in a direction opposite to that of the slate.

Character of the Deposits

Some gold has been found in the drift, but the greatest amount is found at the base of the conglomerate in the matrix, in very thin flakes on the surface of the pebbles or concentrated in crevices in the underlying slate. Those crevices running at right angles to the stratification and cleavage planes were found to be the most highly auriferous. They have been called 'runs' and are really joints from a fourth of an inch to 2 inches wide and extend to a depth of as much as 10 feet. The gold is coarsest and most plentiful along and near the line of outcrop of the conglomerate.

It is believed that the gold was derived from the gold-bearing series. A series of quartz veins, many auriferous and some of great extent, is found along an anticline on the top of the ridge to the south, and it is believed that these veins have contributed the gold, which was concentrated by wave and current action on the shore of the ancient sea.

History.

[3]Discoveries of gold were made here by Berry Corbett and George Gay on their adjoining farms in June, 1862. The discoveries were made on improved land and the price demanded by the owners for permission to enter upon the land and carry on prospecting and mining was almost prohibitive, and for some time retarded the exploration of the district. Several applications were made in July, 1863, for mining lots on David Corbett's farm and later in the year on Mr. Gay's farm, and such appl

[1] D. Honeyman. Trans. N.S. Inst. Nat. Sc. Vol. II, Pt. I, p. 76.
[2] Faribault. Geol. Sur., Can., Ann. Rep., Vol. V, 58 AA.
[3] Heatherington. Guide to the Gold Fields of Nova Scotia, p 68.

Gays River gold mine.

ations were received on the applicants depositing with the Chief Gold Commissioner the requisite written authority from the owner of the soil to enter upon his lands.

In 1868, prospects were a little brighter and a small crusher was erected but was not kept very busy. In 1869, considerable work of an exploratory nature was carried out and consisted chiefly of tunnels along the bed of conglomerate. Messrs. Werner & Co drove a tunnel 200 feet long, sank two shafts, and connected these by tunnel. Messrs. Hopp, Salter, and others drove tunnels on the ground west of Werner & Co.'s property, and still farther west, Messrs. Gay drove over 100 feet of tunnel. Dr. McLean & Co drove about 130 feet of tunnels. Work of about the same nature and extent was done by Mr Moore, and similar work was started by D. Annand. The result of all these operations is not recorded, except that on the works of Mr. Geo. Gay, a depression was found in bed-rock in which a large amount of gold was obtained.

Operations were continued on a small scale in 1870 by Messrs. Gay and Dr McLean, the latter of whom obtained 123 ounces from 617 days labour. Although little was done the next year, the prospects were so encouraging that a new 8-stamp mill was erected. In 1872, the principal work was carried on by Mr. McDonald, who drove a 270 foot tunnel into the hillside along the base of the conglomerate, the softer part of which he removed, leaving the boulders with the waste rock. Work was started on the adjoining area in August. A great deal of rock had to be handled to get at the gold lying at the base of the conglomerate and in the crevices of the underlying slate, but work of this kind was continued by Mr McDonald several years, presumably with profit, and in 1874, a production of 166 ounces was reported. In October, 1875, he temporarily ceased operations on area 10. Other prospecting was done in 1875, but the work was much hindered by water.

In 1876, excavations were continued on areas 4 and 26. Two runs or depressions in the slate were followed 500 feet on the dip and found to end abruptly against a face of slate. On the opposite side of the stream Mr Corbett followed the dip of the bed-rock 80 feet. The following year a number of shallow pits were sunk to the bed-rock, but no paying 'runs' appear to have been found except by Mr. Dunlop on area 3 near the mill dam. He erected a 5-stamp mill and continued work in 1878, driving an inclined tunnel along the base of the conglomerate 200 feet and sending off lateral workings to the 'runs.' He took little of the conglomerate, and mined chiefly the top slate, the crevices of which were filled with clay and often contained pockets of gold.

Messrs. Wilson and Corbett were the chief operators in 1879. They put up a small stamp mill and did some work on the south side of the brook. In 1880, a little work was done by Mr. McDonald on areas 3 and 4, and a little work was done during the following spring.

Since then very little actual mining has been done in this district, although attempts have been made to boom the place. In 1883, some prospecting was done by Mr. Parker, and the following year by Messrs. Pulsiver and Holdsworth. A little prospecting continued during the eighties, and in 1890 the Coldstream Mining Company began the erection of a 50-stamp mill. This was completed in 1891, and some rock was crushed under the management of R. R. McLeod. The erection of the mill created some excitement in the district, but seems to have been ill advised. The venture was a failure, at least so far as mining was concerned, and in 1893 the mill was sold to a company to crush the conglomerate at Memramcook, N.B.

The report of the Department of Mines, Nova Scotia, for 1900, records a second attempt to mine the conglomerate on a large scale, but this apparently met with no better results than that of 1890. In 1900, Norman Logan had sixty-five men at work for the Nova Scotia Gold Mining Company, some old workings were reopened, a 50-stamp mill was erected, and Wilfley tables and a 150 horse-power engine were put in. Thirty stamps were in operation, but the result is not recorded.

Production.

Year.	Gold extracted.			Ore crushed.	Yield per ton of 2,000 lbs		
	Oz.	Dwt.	Gr.	Tons.	Oz.	Dwt.	Gr.
1873	352	17	23	2,984	0	2	8
1874	466	14	14	2,979	0	3	3
1875	250	18	1	2,090	0	2	9
1876	246	10	4	1,699	0	2	21
1877	251	3	15	859	0	5	20
1878	243	11	16	1,126	0	4	
1879	41	0	1	100	0	8	4
1880	13	6	6	40	0	8	15
1881	12	14	7				

Gold Deposits of Cape Breton.

Gold has been found in limited amount at several points on Cape Breton island in quartz veins and in placers. The rocks of the districts consist of altered sediments and intrusives of Pre-Cambrian age, but they can in no way be correlated with the gold-bearing series of the mainland. As each district has its own peculiarities with reference to the geology and the nature of the deposits these matters will be treated in the discussion of the individual districts.

BARACHOIS RIVER

[1] Some white, translucent quartz, carrying small quantities of chalcopyrite and pyrite, and taken from a vein a short distance up Barachois river, near St. Ann bay, Victoria county, gave the following assay

Gold	1·517 ozs. per ton of 2,000 lbs
Silver	2·275 " " "

CHETICAMP.

Location.

The auriferous deposits of this district are found on L'Abime brook indicated on the map[2] as Faribault brook, a tributary of Cheticamp river in the northern part of Inverness county. It is accessible by a wagon-road from Eastern Harbour.

Geology.

Along the coast is a plain broken by long low undulations extending northeast, and back of this is a grand escarpment rising into a plateau of considerable elevation and extending inland. The coastal plain is composed of rocks of the Carboniferous system, while the plateau is composed of various schists, gneisses, and intrusives of Pre-Cambrian age. Along the front of the plateau lies a mass of granite, which has determined the trend of the escarpment and retarded its recession.

[1] Ann. Rep. Geol. Sur., Can., XI, 23 R
[2] Sheet No. 9 of the Nova Scotia series.

Between this and a mass of granite lying farther inland is a belt of sericite, chlorite, and hornblende schists, the ore-bearing series of the district.

These schists are the metamorphic equivalents of a stratified series of rocks, and the planes of schistosity generally coincide with the original stratification planes. The series has suffered a complicated system of folding and faulting. The long wave-like folds extend north-northeast and in the central part of the area they plunge south-southwest or south, while in the northern part they plunge north-northeast. The structure is greatly complicated by faulting and by the cross undulations and contortions developed on the limbs of the main folds.

These schists are cut by dykes of felsite and diorite, which in places appear to be genetically associated with the ore deposits.

The Ore Deposits

The ores are galena, zinc blende, chalcopyrite, arsenopyrite, pyrrhotite, and niccolite. These are more or less auriferous. [2]The schists carry a small amount of gold, which is probably associated with the arsenopyrite with which the rocks are impregnated.

The sulphides lie in lenses and irregularly shaped tabular masses lying in the schistosity planes. These bodies are frequently connected with one another by thin sheets or films of the metallic minerals lying along the planes of jointing, shearing, and foliation. Sometimes bodies of ore are found which lie partly in the foliation planes and partly cut across the bedding in an irregular manner. [3]Quartz veins are found lying in the foliation planes, a few crossing the beds. They are sometimes associated with the ore deposits, but are frequently barren.

It is thought that [4]lateral secretion played no part in the concentration of these ores, but that they were brought from below and deposited in openings produced by the movement of corrugated beds upon one another or by the separation of strata along their bedding planes on account of pressure exerted parallel to the strata. There may have been a subordinate amount of metasomatic replacement.

There are five different ore deposits on L'Abime brook and its tributaries that have received attention.

Galena. This is the deposit on which most work has been done. It lies about a mile up L'Abime brook in a gorge 900 feet below the general level of the plateau. [5]Forming cliffs on both sides of the brook is a garnetiferous sericitic schist, locally known as grey schist, and overlying it and intertongueing with it is a blue, hydromica schist, locally known as the blue schist. In some places fragments of the grey are seen intercalated in the blue. The schists form a syncline with many minor transverse and longitudinal undulations. At the deposit the prevailing dip is N.N.W. 28°.

The ore consists of a mixture of sulphides, galena, zinc blende, arsenopyrite, chalcopyrite, niccolite, and possibly pyrrhotite. In one opening galena predominates, and silver and gold occur, while in another opening the ore is almost entirely zinc blende, the latter deposit being stratigraphically lower than the former. The ores occur in lenses in the grey schist, and in sheet-like masses along the thrust plane at the contact of the blue and grey schists. The lenses lie in the bedding planes or occasionally break across the strata only to follow the bedding planes again. Very little ore is found in the blue schist.

There was considerable excitement in this district in 1896 and 1897, but it was not until 1898 that the Cheticamp Gold Mining Company began active operations. [7]A road was constructed to the deposit, a concentrating plant erected, a dam built half a mile up the brook, and a wooden flume 2,600 feet long and an iron one 29 inches in diameter and 190 feet

[1] Grandin Trans. Nova Scotian Inst. Sc. Vol. XI, p. 352.
[2] Woodman, Dept. Mines, Nova Scotia, 1898, Ore Bearing Schists, p. 20.
[3] Rep. Dept. Mines, Nova Scotia, 1898, Ore Bearing Schists, p. 20.
[4] Rep. Dept. Mines, Nova Scotia, 1898, Ore Bearing Schists, p. 21.
[5] Trans. Nova Scotian Inst. Science, Vol. XI, p. 359.
[6] Rep. Dept. Mines, Nova Scotia, 1898, Ore Bearing Schists, p. 20.
[7] Rep. Dept. Mines, Nova Scotia, 1898, p. 51

long were constructed. Shafts were sunk on the galena deposit and on the zinc blende deposit. In November, fifty tons of ore was concentrated yielding 10,713 pounds of concentrates which were found to contain 25·3 per cent lead, 22 ounces silver, and 3 pennyweights gold per ton. The Report of the Department of Mines, 1900, p. 58, states that the shafts were deepened and new levels started, that by crushing, sizing, and concentrating on Wilfley tables a very satisfactory separation of the galena was made. The following assays were given:—

	Lead.	Gold, oz., per ton.	Silver ounces
Unroasted product before concentration.	20·78	0·133	18·1
Unroasted concentrates..	52·97	0·40	37·2
Tailing..	1·95	0·10	5·1

The report for 1901, page 70, states that profitable concentration presented some difficulties, which it was believed they had overcome, and arrangements were made for putting in a compressed air plant and improved milling and concentrating machinery.

Grandin Brook Copper Deposit.—This is situated on a small brook flowing into McLeod Brook, a tributary of L'Abime brook. Here there are several beds, probaly 250 feet thick, of sericite and chlorite schists, known as the copper schists. At their outcrops in Grandin brook they strike N.N.E. and dip E.S.E. 15°, but they are much contorted and faulted. These schists are impregnated with chalcopyrite, but there is an absence of arsenopyrite.

Chalcopyrite and pyrite occur in small lenses, and in sheet-like masses, the openings for which, it is thought, were formed by the spreading of the beds on account of pressure exerted parallel to the strata. The metallic contents have been leached from the schists to a depth of 5 to 15 feet. Below this is a zone of oxidized ore which passes gradually into a zone of unoxidized chalcopyrite.

The work done here consists of a slope at its most southerly outcrop and some openings and stripping. In 1905, it was owned by the Cheticamp Copper Company, Limited, Halifax.

Mountain Top. This deposit occurs in the deep gorge of McLeod brook near the mouth of the Grandin. It consists of the following beds beneath the copper schists:

(1.) Chlorite schist. Thickness not known.
(2.) Sericite " 1½ feet.
(3.) Chlorite " 25 "
(4.) Sericite " 50 "

No. 1 is harder than the normal chlorite schist and carries auriferous arsenopyrite and chalcopyrite lenses and veins. No. 3 is much softer and carries arsenopyrite and pyrrhotite, while No. 2 carries auriferous arsenopyrite. From No. 4 samples of arsenopyrite have shown a gold content of $90 per ton.

This was owned in 1905 by the Richfield Mining Company, Limited, Halifax.

Iron Cap.—This is also on McLeod brook. A bed of chlorite schist forms an anticline the limbs of which dip east and west at low angles. Auriferous arsenopyrite and pyrrhotite occur in lenses and veins. The deposit may be divided into two zones, an upper in which pyrrhotite predominates, and a lower in which arsenopyrite is the principal ore. A tunnel has been driven into the ore body 100 feet. In 1905, it was owned by the Richfield Mining Company, Limited, Halifax.

Silver Cliff.—This is an argentiferous galena deposit on L'Abime brook about a mile and a half south of 'Galena.' The rock is chlorite schist resting on a corrugated sheet of white quartz, below which is a dark hornblendic rock showing an imperfectly developed schistose structure. This deposit was owned in 1905 by the Inverness Mining Company, Limited, Halifax.

[1] Trans. Nova Scotian Inst. Sc. Vol. XI, p. 358

Alluvial Gold

Alluvial gold has been reported occasionally from this district. [1] On L'Abime brook some panning has been done on a small scale and perhaps some of the other brooks would yield a little gold, but generally the conditions are not favourable. The grade is steep and the valleys narrow. Some gold has been found in the lower portion of the valley of the Chéticamp, and it is covered with boulders and gravel, but the rocks higher up have not been found to contain any appreciable quantity of gold and it is improbable that the alluvium is worth prospecting.

MIDDLE RIVER OF WAGAMATKOOK

Location

The Middle River district is situated in Victoria county on Middle river and about 15 miles from Baddeck. Finlayson is the nearest post-office. It includes a strip of land lying along a short portion of Middle river, and the area drained by four small tributaries, the First, Second, Third, and Fourth Gold brooks. These brooks are named according to the order in which they are met in ascending Middle river; they have a generally westward flow, and are from half a mile to a mile apart. The country is a flat upland 700 to 900 feet above sea-level. The brooks follow to a great extent the structure of the rocks and in their lower courses have cut deep narrow valleys.

Geology

"[2] So far as seen, the glacial drift which mantles the bed rock throughout the lowland areas does not reach the Gold brooks. A clue to the different formations can, therefore, be obtained by a study of the loose material overlying them.

The rocks of this area consist of schists, shales, and slates of Pre-Cambrian age along with intrusives of various kinds. The lower half-mile of First brook, as well as Middle river below this point, flows over rocks of Carboniferous age, from which the country rises with a rather steep grade to the Pre-Cambrian plateau.

Along Middle river between the Gold brooks are outcrops of chloritic and sericitic schists. In the lower courses of First and Second Gold brooks is a garnetiferous gneiss containing much chlorite and sericite. In Second Gold brook, where these schists are exposed as far as 2,000 feet from its mouth, the beds are knotted and crumpled and manifest early stages in the formation of garnets. The foliation and bedding planes coincide and the strike is fairly uniform and persistent in an east and west direction. The variation in strike on Second brook due to crumpling is only local. The strata d[illegible] north at high angles. South of this is a mass of hornblende sy[illegible] feet wide, much weathered, and under the microscope seen to c[illegible] orthoclase feldspar, biotite, a large amount of hornblende, and [illegible] apatite. These minerals show dynamic distortion. This syenite [illegible]s wider towards the east, but has not been recognized on First brook at the west. South of this intrusive is a peculiar black schist which may be a more metamorphosed portion of the series of schists already described or may be of quite different origin.

[3] Following this, and about 2,500 from the mouth of Second brook, is a dyke of quartz porphyry 15 to 30 feet wide. The outcrops on First brook from which it has been traced eastward 3½ miles. It has the same east and west strike as the schists, but appears to dip at a slightly higher angle. The main portion of the dyke carries phenocrysts of quartz and a few of orthoclase embedded in a fine-grained pinkish ground-mass, while the margin, which shows a banded structure parallel to the contact, is destitute of phenocrysts, takes on a felsitic appearance, and is pinkish

[1] Report, Dept. Mines, Nova Scotia, [illegible] Ore Bearing Schists, p. 23.
[2] Woodman. Rep. Dept. of Mines, Nova Scotia, 1898. Ore Bearing Schists, p. 7.
[3] Rep. Dept. Mines, Nova Scotia, 1898, Ore Bearing Schists, p. [illegible]

brown in colour. It is only this marginal phase which is exposed on First brook. Under the microscope evidence of resorption of the quartz crystals is seen. They are surrounded by a thick rim of quartz particles and a brown polarizing mineral with regular crystal outlines. There are also tufts of radiating fibres of a brown non-polarizing mineral, which, with some plagioclase, constitute the ground-mass.

Beyond this dyke and extending a mile from the mouth of the river are outcrops of schists similar to those near the mouth of the brook, but dipping at a higher angle. To the south of this is a mass of granitite from which the schists dip off steeply to the north. This granitite is acidic, is triable, quite coarse, and of a red colour.

The general sequence of rocks is the same on Third and Fourth brooks as on Second brook.

Character of the Deposits.

The vein that has received most attention is the Lazard lode which is found on Second brook about a mile from its mouth. [1] It is composed of quartz and carries in places aresenopyrite, chalcopyrite, galena, and other sulphides. The following is an analysis of a sample of concentrate:

Arsenic..	26·26	per cent
Iron..	35·36	"
Sulphur..	27·46	"
Silica, alumina, etc..	8·68	"
Nickel..	trace	
Gold..	2·14	ozs. per ton.
Silver..	2·46	ozs. "

Platinum is said to have been found in the alluvium, also [2] waterworn nuggets of native bismuth from the size of a grain of wheat to that of a pigeon's egg.

In form the vein is very irregular. In width it varies from a fraction of an inch to 6 feet. It often shows a banded structure parallel to the margins, and drusy cavities near the centre. It has about the same strike as the strata, and its dip varies from nearly vertical to nearly horizontal. It occurs in the schist, but the hornblende syenite lies close to the foot-wall. One wall is fairly well defined, sometimes the foot-wall and sometimes the hanging-wall.

There are several quartz veins in the vicinity of Lizard lode, a few crossing the bedding, but the most being conformable with it. Near the porphyry dyke also are numerous quartz veins, which decrease in number with distance from the dyke. The mineralization of both the bedded and cross veins near the dyke is different from that in other parts of the schist series.

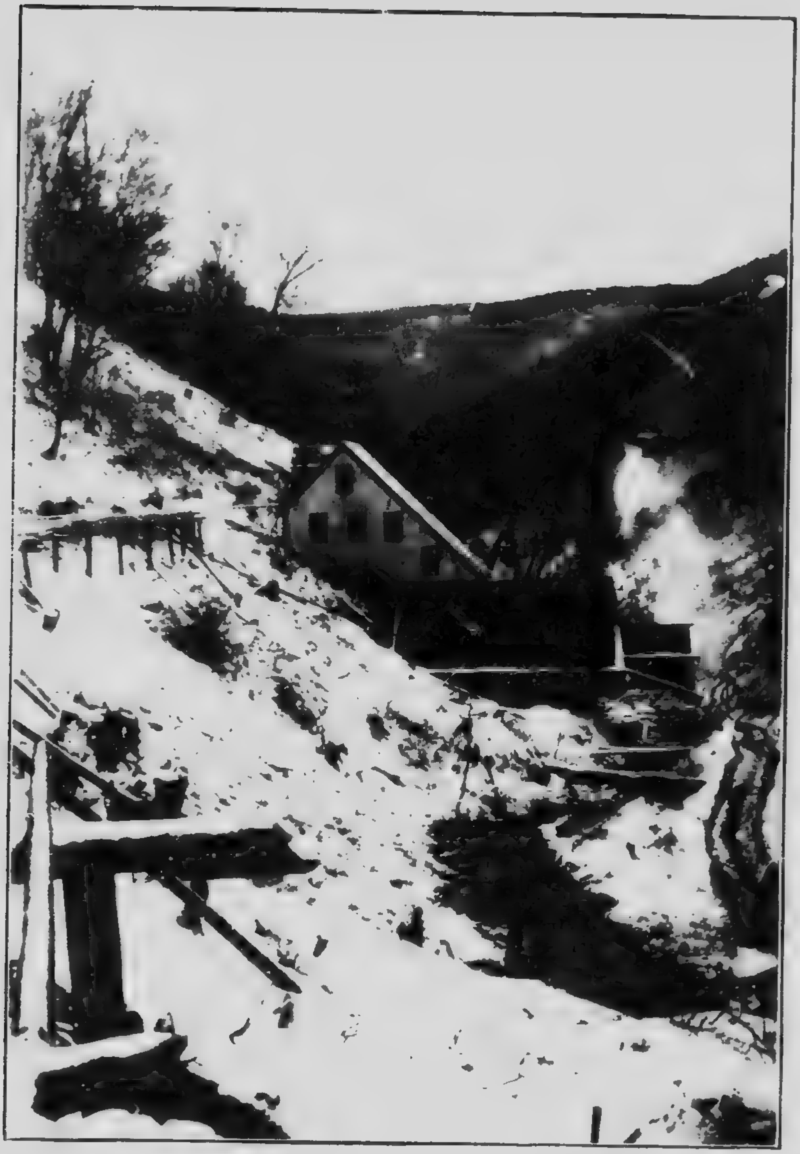
Close to the opening of the glen on First brook are several quartz veins, much stained with limonite, while in the vicinity of the porphyry dyke are a few barren veins, although much quartz is scattered over the hillside and in the brook. On Third and Fourth brooks are a few quartz veins.

Some attempts have been made to mine the alluvium in this district. It is said that some gold has been obtained in Midde river for a considerable distance below First brook, but it is improbable that it will prove economical. In the flats between First and Second brooks is an area which may contain gold carried from Second brook. In the lower part of First brook, where its valley widens, some alluvium had accumulated, but the most promising alluvial deposit is probably at the mouth of Second brook, inasmuch as this stream crosses what are apparently the most highly auriferous veins.

History and General Development.

[3] Fletcher reports that a farmer, named Morrison, was the first to call the attention of the government to the gold of this district, for which

[1] Rep. Dept. Mines, Nova Scotia, 1906, p. 108.
[2] How, Mineralogy of Nova Scotia, p. 63.
[3] Rep. Dept. Mines, Nova Scotia, 1898. Ore Bearing Schists, p. 9.
Report of Progress, Geol. and Nat. Hist. Surv. and Museum of Canada, 1882-84, 97 H.



Great Bras D'Or Gold Mining Co's crusher, Middle river.

he received an area on one of the brooks free, and he became one of the most succesful in washing out gold. On the other hand [1] Heatherington states that J. G. McLeod received a free claim in April, 1861, which implies that he was the original discoverer. J. Campbell, in his report dated Feb. 25, 1863, relates that he washed gold from the sand of Middle river, and expresses the opinion that work skilfully conducted here should prove remunerative.

The prospect seemed so promising that in 1863, the Chief Gold Commissioner recommended that this locality be proclaimed a gold district. The district did not come up to expectations, however, and little work was done, owing, it was thought, to its inaccessiblity. [2] The first attempt, on an extensive scale, to test the gold in Middle river was made in 1867 by an American company. They constructed sluices near McLennan's bridge, on the Margaree road, washed the alluvium during the summer, but discontinued their work, as the receipts did not cover expenses. In 1870, a Mr. Wright and others tested all the brooks above McLennan's bridge by means of cradles, sluices, and pans. They also started a shaft in the main river to reach bed-rock, but an influx of water compelled them to desist. The largest nugget found is said to have been worth $12 to $15, but generally they ranged in value from 50 cents to $2. In several cases gold was found adhering to quartz. [3] In 1868, several auriferous veins had been found and a crusher was in the course of erection, but we find no record that returns were ever made from it.

In recent years the district has again received some attention, and both alluvial and lode mining have been carried on. [4] In 1902, some Chinamen were washing for gold, and Mr. Scranton had erected a small crusher and was mining a quartz vein, the Lizard lode, into which he had driven a long tunnel. Since 1906, the Great Bras d'Or Gold Mining Company has been working this property. Adits have been driven on this vein on both sides of the brook, and some cross-cutting done. Stoping has been carried on from three levels. The mine is equipped with steam power, an air compressor, a stamp mill, and a Wilfley concentrating table.

[5] From 2,800 tons of quartz crushed in 1908, 590 ounces of gold was recovered, and 708 ounces were recovered from 1783 tons in 1909.

WHYCOCOMAGH.

Location.

The Whycocomagh district lies in Inverness county, 1½ miles north of the village of Whycocomagh at the head of St. Patrick channel.

Geology.

On a hill here is exposed a series of rocks of Pre-Cambrian age consisting of [6] quartzite, diorite, syenite, quartz-felsite, calcareous, breccia and crystalline limestone. Surrounding these are lower Carboniferous sediments. Some work has been done in these ancient rocks near the head of the brook lying to the south of Mullach brook. A tunnel cut northward from the brook gives the following section. [7]

1. Dark green schist..	10 feet
2. Limestone, strike N. 65°W. (mag.) dip 48°N..	15 "
3. Quartzite..	100 "
4. Limestone to end of tunnel..	15 "
	140 feet.

[1] Guide to the Gold Fields of Nova Scotia, p. 67.
[2] Rep. of Progress, Geol. and Nat. Hist. Surv. and Museum, 1882-84, 97 H.
[3] Report, of Chief Gold Commissioner, Nova Scotia, 1868.
[4] Ann. Rep. Geol. Sur., Can., XV, 395 A.
[5] Report Dept. Mines, Nova Scotia, 1908, p. 108.
[6] Fletcher. Report of Progress, Geol. Sur., Can., 1882-84, 34 H.
[7] Report of Dept. Mines, Nova Scotia, 1898, Ore Bearing Schists, p. 14.

The figures are only rough estimates and are not intended to represent the thickness of the strata. South of the tunnel, near its mouth, is more quartzite. Down the brook is a wide belt composed of alternations of quartzite and limestone, followed by 500 yards of coarse, pink granitite, which in turn is succeeded southward by quartzite to the edge of the Pre-Cambrian area. Northward from the tunnel the outcrops in the brook consist chiefly of limestone.

[1] The contact of the limestone and the dark green schist of the section given has the same strike and dip as the banding of the limestone. The schist at the contact is soft and crumbly and tongues into the limestone. The quartzite has a shear-zone at each contact. The quartzite is said to have been described by some as felsite, but "thin sections under the microscope show a fragmental character, the quartz grains and secondary quartz being easily seen. The grains are extremely fine, and interlock closely." The cement consists of quartz, calcite, and some undetermined mineral.

Character of the Deposit

[2] "The ore throughout this region consist, to the eye, chiefly of massive and granular arsenopyrite. Here and there is a little pyrite or chalcopyrite, but these are not abundant. The sulphides sometimes occur in veins of quartz, but usually in the country-rock without gangue. Where the limestone is mineralized, the metals lie along the planes of schistosity, and their general distribution appears to bear no relation to the presence or absence of veins. The chief part of the ore is to be found in the quartzite; and where the limestone contains sulphides, quartzite is usually not far distant. In places where this rock appears to merge into the dark green schist, the ore runs for some distance into the latter; but as a rule the schist is barren. Almost all the quartzite is impregnated with arsenopyrite to such an extent that particles of it are visible in every piece. Frequently, however, the mineral is concentrated in bands or lenses, roughly parallel with the contacts of the quartzite with its neighbours. A number of these lenses cross the brook or are visible on its side within half a mile north of the tunnel. In a few cases distinct lenses are visible in quartz veins. At a distance from the tunnel an increasing proportion of pyrite and chalcopyrite appears." Assays of some samples taken by Woodman showed traces of gold but no silver.

Genesis

Although it has been stated that the connexion of the ore was with the metamorphic limestone Woodman is of the opinion that the metallic compounds were carried into the unaltered sandstone by solfataric action, and were possibly concentrated by the agencies that converted the sandstone into a quartzite.

General Development.

There was some excitement in the latter part of 1897 and the early part of 1898 over the discovery of the mispickel, which it was claimed was very rich in gold, and a tunnel 1[illegible]0 feet long was cut, but work was not long continued. Sluicing on a small scale has been carried on with success, but the valley of the brook will not permit of the accumulation of much alluvium. It is thought that two or three men could earn labourers' wages from it. The valley of Mullach brook widens out after leaving the Pre-Cambrian area and considerable alluvium has accumulated. Pits have been sunk which show it is 4 feet deep, and in some places more than that. The material, which is never very fine, varies much in texture and consists of granite, pink and grey quartzite and quartz pebbles with quartz sand carrying garnets and magnetite. It is claimed that it yields $2 to $3 per ton, and that the gold is not in flakes, but is in fairly coarse, irregular masses.

[1] Rep. Dept. Mines, Nova Scotia, 1898, Ore Bearing Schists, p. 14.
[2] Rep. Dept. Mines, Nova Scotia, 1898, Ore Bearing Schists, p. 15.

MISCELLANEOUS

Mercury.

[1] Mercury has been reported from Waverley, and both mercury and cinnabar from Gays river. [2] It was also reported as occurring in a partly destroyed glacial moraine between the First and Second Dartmouth lakes, but as minute globules of the metal were also found resting on the grass and moss it is probable that it was transported by other than glacial agencies.

Lead and Silver.

The occurrence of a small amount of silver associated with the gold from some of the auriferous veins, and of galena in some veins, has been mentioned. Argentiferous galena has been found in small quantities outside of the gold deposits. [3] It had been known for a number of years that there was argentiferous galena in the drift near the Meaghers Grant road, 3 miles northwest from Musquodoboit harbour, but although quite a little prospecting had been done it was not until 1909 that the source of the galena was found. A number of test pits were sunk and surface tunnels driven, and a body of ore was found carrying galena, chalcopyrite, and malachite. On this shaft has been sunk 100 feet and a level started.

[4] Another deposit that has received some attention is that at Smithfield, on the south bank of West River St. Mary, 2 miles west of Glenelg. In the seventies some development work was done at this place on some veins cutting the quartzite lying between a granite intrusion on the south and the overlying Carboniferous conglomerate on the north. The mineral consists of argentiferous galena, and an analysis by H. S. Poole shows that it runs from 1[illegible] to 17 ounces of silver per ton. Some tunnelling was carried into the hill along a vein past the intersection of another vein, and the second vein was also followed a short distance. A shaft was sunk 25 feet and a tunnel started under the river. A small amount of ore was

[1] How, Mineralogy of Nova Scotia, p. 61.
[2] Report of the Department of Mines, Nova Scotia, 1897, p. [illegible]
[3] Rept. Dept. Mines, N.S., 1909, p. 175.
[4] Rept. Dept. Mines, N.S., 1876, p. 61.
[5] Report of the Department of Mines, 1877, p. 47

taken out, and in 1876, 12,700 pounds, and in 1877, 19,000 pounds were shipped to England. The quantity of ore obtained was small in proportion to the expenditure, and operations ceased.

Faribault describes a belt of fine grey limestone at Gays River corner which carries argentiferous galena. The beds lie unconformably upon the Goldenville formation. [1]"The galena is found neither in veins nor pockets, but in small crystals generally diffused through the limestone. It is in spots aggregated about small cavities, but nowhere otherwise than in small grains. This was discovered early in the nineteenth century, and has been much prospected. Wherever opened the beds seem equally charged with the galena, the upper equally with the lower, and over a considerable area. Hand specimens may be found yielding 15 per cent, but the rock requires picking to give an average of 3 per cent. Analysis gives 11½ ounces of silver per ton of lead. [2]"The grains of galena are so fine and intimately blended with the limestone, that trituration will be necessary for separation. This can only be done at a considerable expense and at a proportionately large loss of ore."

Tin.

[3]"As early as 1868 tin is reported by Professor How to have been found at Tangier by W. Barnes in a sand composed of quartz and decomposed feldspar, and Dr. E. Gilpin also obtained it in panning gold in the same locality. It was also reported at Shelburne by J. Cor[illegible] at Rawdon by Harry Piers, and at Country Harbour and Malaga. Such finds were all connected with drift material." [4]It was also reported by Dr. Genth as found in the form of minute crystals in some tailings from the Battery lead, Malaga district, Queens county.

A discovery of cassiterite in situ was made in the autumn of 1906 in the granite about 3¾ miles west of New Ross, Lunenburg county, and three-eighths of a mile south of the Dalhousie road. [5]Charles Keddy, of Lake Ramsay, in examining some material from a prospect pit made by John Reeves and Benjamin Meister, found a dark coloured mineral which on being examined in Halifax proved to be cassiterite. The quantity was very small.

[1] Ann. Rep. Geol. Sur., Can., V, 58 AA.
[2] Rep. Dept. Mines, Nova Scotia, 1874, p. 55.
[3] Summary Report Geol. Sur., Can., 1907, p. 81.
[4] Ann. Rep. Geol. Sur., Can., Vol. IV, Part I, p. 26.
[5] Report of the Department of Mines, Nova Scotia, 1906, p. 92.

A pit about 18 feet deep, 12 feet long, and 10 feet wide wa[illegible], but the deposit has not proved of economic importance.

[1] The cassiterite occurs in a pegmatitic mass within a body of light grey, medium-grained muscovite granite. The pegmatite is coarse, is composed chiefly of quartz and more or less decomposed feldspar. In the centre a number of large, transparent, vitreous quartz crystals with one termination were found embedded in kaolin. Some of these were 27 inches long and 10 inches thick. Small quantities of a great many minerals, characteristic of pegmatites have been found, such as wolframite, scheelite, blue, pinkish, and greenish amblygonite, cassiterite, a lithia mica, green apatite, purple fluorite, durangite, columbite, beryl, and gummite. "The occurrence of amblygonite and durangite in Canada had not previously been recorded.

The excitement created by this discovery led to considerable prospecting in the vicinity of New Ross, and the examination of several small pegmatitic schlieren, aplite dykes, and quartz veins. In a pegmatite mass on Dr. Lavers' and Frank Boylan's claims, about 1 mile east of New Ross, traces of bismuthinite and of a tungsten-bearing mineral were found, and in a quartz vein, known as the Turner vein, about 3 miles north of New Ross, and near a point a half mile down the stream that drains Camp lake, some cassiterite was found along with tungsten minerals and chalcopyrite. A shaft has been sunk on this vein. Traces of bismuthinite and molybdenite were found in some of the small dykes and quartz veins of the vicinity.

Nickel and Cobalt.

[3] "The presence of nickel and cobalt in the pyrites of our gold-fields, etc., should not be overlooked. In samples from Musquodoboit and S[illegible]y, which have come under my notice, these metals have been present in quantities up to 3 per cent."

Tungsten.

Tungsten minerals have been found in several different localities in the gold-bearing series, and there are one or two deposits that give promise of becoming of economic importance.

[1] Summary Report, Geol. Sur., Can., 1907, p. 77.
[2] Summary Report, Geol., Sur., Can., 1907, p. 96
[3] Geol. Sur., Can., VIII, 9 R.

Wolframite, hubnerite, and scheelite have been found very sparingly in pegmatite dykes and quartz veins in the granite in the vicinity of New Ross, Lunenburg county. Scheelite of a light smoky grey colour was found associated with pyrite and arsenopyrite in a quartz vein intersecting and cutting off the pay-shoot of the Rabbit lead at the Ballou mine, Malaga, Queens county. [1] Its specific gravity at 15·5° C. was found to be 6·002, and analyses made by R. A. A. Johnston gave the following:

	1	2	Mean
Tungsten trioxide	78·95	79·08	79·01
Calcium monoxide	19·75	19·85	19·80
Carbon dioxide	0·73	0·70	0·71
Insoluble matter	0·10	0·12	0·11
			99·6[illegible]

[2] Concentrates collected by T. L. Walker from the Ballou, Minneapolis, and Molega mines failed, however, to show even a trace of tungsten. Traces of scheelite were found by F. H. Mason in the tailings from the Lake lode, Caribou, and concentrates collected at Caribou were found to contain 0·22 per cent tungstic acid. A sample collected in June, 1908, at the Moose River mill, contained 0·52 per cent tungstic acid. But most important of all are the discoveries made at Moose River and at Waverley.

MOOSE RIVER DEPOSIT.

Location. This deposit lies in Halifax county, 2 miles west of Moose River Gold Mines, on the Stillwater brook. It is represented on the Moose River sheet, No. 50, by a number of quartz veins.

Discovery. A few years ago a trapper picked up [illegible] of Moose River a white stone which he preserved on [illegible] high density. This was carried by a Mr. Thomas [illegible] where it was identified as scheelite. The source of this [illegible] however, was not discovered, but it is probable that it was derived from the Moose River deposit. In 1907 a [illegible] powder was found on a quartz boulder [illegible] St[illegible]

[1] Geol. Sur., Can., VIII, 9 R.
[2] Walker. Report on the Tungsten Ores of Canada. Mines [illegible] Dept. of Mines, Canada, p. 28.

John A. Reynolds and W. S. Currie [illegible] in May 1908, that the powder—a mixture of tungstite and scheelite—was possibly derived from a deposit that might prove of value. Reynolds [illegible] ing. The drift was carefully examined, and the search was carried on so systematically that within two weeks scheelite [illegible] discovered.

Geology. The rocks of this area are of the Goldenville formation, heavy beds of quartzite alternating with graphitic slate. The lowest known strata of this formation are here exposed. These show some signs of metamorphic change; the quartzite has become somewhat schistose and the black specks throughout the slate give evidence of incipient recrystallization and of a tendency towards the formation of a knotted phyllite. The rocks adjacent to the veins carry much white, scaly mica. They are much rusted on the surface. The slate carries numerous well formed crystals of arsenopyrite, commonly surrounded by a narrow zone of white mica with scales at right angles to the surface of the mispickel, while the quartzite or quartz schist is dotted with smaller rusty specks, many of which are lenticular and probably result from the oxidation of arsenopyrite.

Although the rocks are much covered with drift, a sufficient number of exposures are obtained in the brook and in surface and underground explorations to permit of the determination of the structure. The Fifteenmile Stream and Beaver Dam anticlines converge from the east and join in this vicinity. A section of the rocks along this brook gives within a dis[illegible] anticlines and two synclines, which have a general [illegible] course, and plunge [illegible] to 17°. There may [illegible] yet detected. The [illegible] high angles, 50° to 90°. Just west of [illegible] important fault crossing the strike of the strata. A[illegible] strata on the two sides of this break have been correlated [illegible] the exact [illegible] from 80 to 160 feet, and the displacement is towards the north on the east side.

On the east side of the [illegible] width [illegible] limbs of the [illegible]

more northerly anticline and have been traced around the apex of the fold. Scheelite is found on the legs of the veins, but not on the apex. Two veins have been found on the north limb of the anticline immediately to the south and two on the south limb. It is in one of the veins on the north limb that the lenticular masses of ore were found. Shafts sunk on this vein have proved the existence of an ore-shoot 1 to 4 inches thick, outcropping at the east end and pitching west at a low angle. The other vein on this limb carries a little scheelite. The New vein, the more southerly of the two on the south limb of the anticline, is the most important one in the district. This has been opened by means of pits and shafts throughout a length of 620 feet. Three shafts sunk on it show the existence of an ore-shoot, 30 feet in vertical extent and with a mean thickness of 2½ inches, outcropping at the east end near the little brook and pitching to the west at an angle of 9°. This ore-shoot extends downward close to the trough of the syncline. At the west end of the vein there is found some scheelite at a higher level, which may prove the beginning of a second ore-shoot. The second of the two veins on the south limb carries a small amount of scheelite on its walls. It may be that the two veins on the north anticline, and the two on the north limb and the two on the south limb of the next anticline to the south are but portions of simply two continuous veins which have been repeatedly exposed by the denudation of the two anticlines. In a cross-cut driven south from the shaft at the west end of the New vein four other veins have been intersected. The veins on the east side of the fault are found to curve southward by a series of step faults on approaching the main fault.

On the west side of the fault the veins have been found to lie on two anticlines and the intervening syncline within a width of 80 feet. The north vein has been traced from the north limb of the north anticline over the apex, down the south limb into the syncline and up the north limb of the next anticline. The richest part of this vein consists of an ore-shoot, 1 to 3 inches thick, lying on the south limb of the north anticline and extending from the apex of the fold to the bottom of the syncline a length of 60 feet as exposed on the surface. This ore-shoot has been followed to a depth of about 300 feet by an incline shaft sunk along the trough of the syncline, which plunges to the west at an angle of 10°. At the very bottom of the syncline the vein thickens and changes to quartz, but scheelite is seen in the shaft to come in again on the north dip of

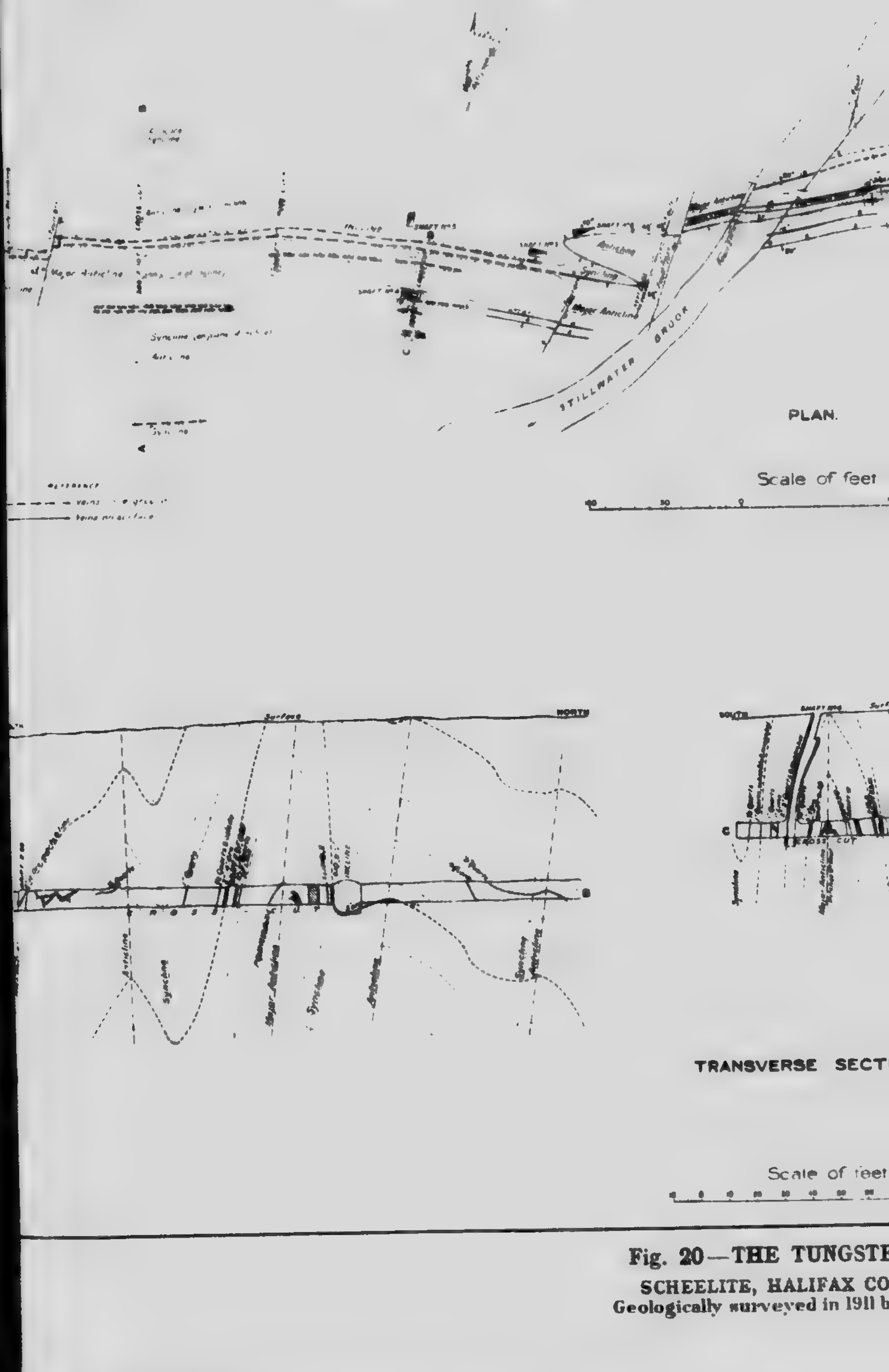
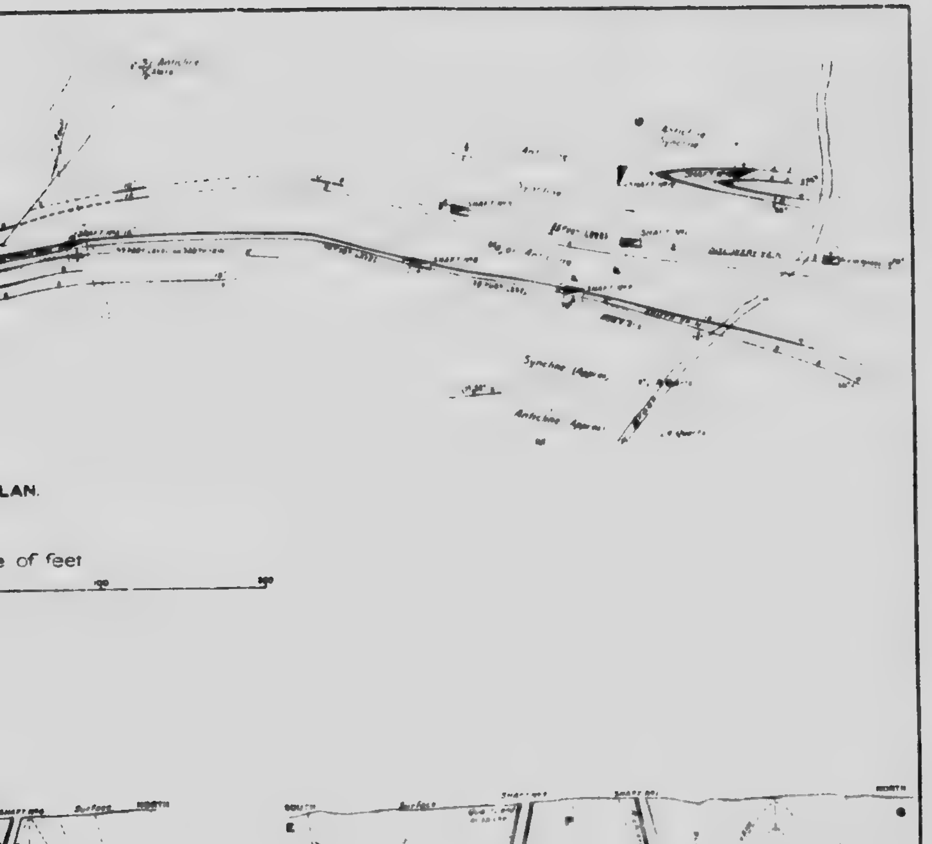


Fig. 20—THE TUNGSTE

SCHEELITE, HALIFAX CO
Geologically surveyed in 1911 b



To accompany Memoir No. 20

TUNGSTEN DEPOSIT

LIFAX COUNTY, N.S.

ed in 1911 by E.R.Faribault

the southern anticline. In a cross-cut driven south from the incline shaft at a depth of 55 feet the following veins were cut: two dipping north, one of which, 3 inches thick, bears scheelite at the point where it was cut; one on the apex of the fold; and three dipping south, one of which, 3 to 5 inches thick, carries scheelite.

A few other scheelite-bearing veins have been found, but not thoroughly explored. There is also a possibility that many found to be of no value on the surface may carry ore at lower levels.

A remarkable feature of these scheelite deposits, as opposed to most deposits of tungsten ore, is their continuity in form and constancy in tungsten contents.

Outside of this immediate district, scheelite has been found 2 miles east at Moose River Gold Mines: in the Dowell lead at a depth of 200 feet in Kaulback's vertical shaft, pieces the size of a hen's egg have been found in quartz; and at a depth of 90 feet in the George Cameron shaft, on the Moose River Gold Mining Company's property, a pocket was found containing a few pounds of scheelite.

No igneous rock is known in this district, the nearest granite exposure being 7 miles south and southwest, but it is not improbable that an igneous mass underlies or intrudes these sedimentary rocks.

Character of the Deposit.—The vein matter consists of scheelite, mispickel, and translucent white quartz in varying proportions. Scattered throughout the veins are patches of fine, white, scaly mica with a silky lustre, and embedded in the scheelite and quartz are a few needles of black tourmaline. White crystalline dolomite is found in a few veins. No pyrite, pyrrhotite, or galena had been observed, and in this respect these veins differ from the auriferous veins of the Province. Numerous assays made by A. L. McCallum, of Halifax, have failed to detect any traces of gold.

The scheelite is coarsely granular, translucent, honey-yellow to pale brown in colour, and shows distinct cleavage. Some large crystals showing the simple pyramid have been found, constituting the lenses of one of the veins, and lying with their vertical axes parallel with the long axes of the lenses. As has been suggested by Walker, all these lenses may consist of deformed crystals. [1] Analysis of the scheelite by D. E. Beynon gave the following result:

[1] Report on the Tungsten Ores of Canada, pp. 26 and 28. Walker

WO	78·62
MoO	1·34%
CaO	19·58%

The following is the result of an analysis made by A. L. McCallum:

WO	79·84%
CaO	20·11

[1]An analysis of an average sample of the ore resulted as follows:

Tungstic acid (WO_3)	44·10
Lime	12·70
Silica	29·29
Arsenic	3·43
Sulphur	1·46
Oxides of iron and aluminium	7·70

The veins are of the interbedded type, and lie in the slate belts interstratified with the quartzite. In this they are similar to the auriferous veins of the Province. Like these also, many of them show rolls dipping to the west at low angles, corresponding with the plunge of the anticline. They vary in thickness from a fraction of an inch to 24 inches, but those carrying the most scheelite do not average more than 4 inches. One vein is made up of a succession of lenses consisting possibly of a series of large deformed crystals.

The origin of the deposit is not known, but the evidences of contact metamorphism in the slates, and the mineral content of the veins, the tourmaline, scheelite, and mispickel, point to the possibility of a genetic connexion with an underlying igneous mass, probably a granite.

Development.—Development work is in progress. Much trenching has been done and veins have been traced by means of pits and shafts. The most important work is that done on the New vein and in the incline shaft. On the New vein three shafts have been sunk about 60, 70, and 100 feet deep, and from the west shaft a short cross-cut has been driven south. On the west side of the fault an incline shaft has been sunk about 300 feet in the trough of the syncline, and at a depth of 55 feet a cross-cut has been driven a short distance south. This cross-cut is connected with the surface by a nearly vertical shaft, and short levels have been driven on two of the veins intersected in the cross-cut.

[1] McCallum, Can. Min. Journal, 1908, p. 456.

In the development work up to December, 1910, 171·6 tons of ore containing 25·50 tons of tungsten trioxide had been taken out. This at $8 per unit, it is calculated, would be worth $20,400.

The treatment of the ore at the mine will probably consist of crushing, sizing, concentrating, and slight roasting followed by magnetic concentration.

THE WAVERLEY DEPOSIT.

Another deposit occurs 1½ miles north of Waverley station and east of Windsor Junction station, between Perry lake and the old Cobequid road. A quartz vein in this vicinity was prospected for gold 10 or 12 years ago by some Indians. These men recognized in a specimen of scheelite from Moose River a mineral similar to what they found in the quartz 10 years previously, and specimens taken from this vein in 1908 were proved by A. L. McCallum to be scheelite. The vein is not auriferous, and carries considerable scheelite. It is an interbedded vein, has a fairly uniform thickness of 6 inches, and lies in a slate belt of the Goldenville formation, some distance to the north of the Waverley anticlinal axis, and, therefore, on the same great upheaval as that on which the same mineral was found at Moose River. A short distance south of this is another quartz vein carrying scheelite, but it has not been carefully examined, nor have several other quartz veins in the vicinity.

It is evident that tungsten-bearing minerals are of fairly wide distribution throughout the gold-bearing series, and probably of wider distribution than the discoveries indicate. Owing to its non-metallic lustre it is not a mineral that would strike the eye of the prospector for gold, and a systematic examination of the veins and dumps in the different gold districts might be rewarded with further valuable discoveries.

Molybdenum.

Molybdenite, the disulphide of molybdenum, is found sparingly in different parts of Nova Scotia. It has been repo ed from various places, such as [1] Musquodoboit, Hammond Plains, New Ross, and on a tributary of the Jordan river. Near New Ross it occurs in pegmatites and in small cracks in the granite, but it has not been found in economic quantity.

[1] Report of the Department of Mines, 1886, p. 18.

Manganese.

Although the discovery of manganese ore has been reported from so many localities as to show it is of wide distribution in the gold-fields of Nova Scotia, yet the quantity has been so small that the mining of the ores has never assumed great importance. No description is given in this report of manganese occurrences outside the gold-fields of the Province. The ores are pyrolusite, manganite, and the less valuable wad.

Among the localities from which it has been reported are Ship Harbour, St. Margaret bay, Shelburne, Bridgewater, Chester Basin, Jeddore, Mount Uniacke, Rawdon, Wolfville, and New Ross. How (1868) says that it occurs in pockets carrying about 100 pounds of ore running 70 per cent manganese peroxide at Fenerty's, 19 miles north of Halifax; that about a ton of pyrolusite and psilomelane was taken in 1864 from a hard siliceous rock in slate at Greenwich, near Wolfville, and that brown wad was at one time shipped from near Jeddore to England. He also mentions that bog iron and manganese of different grades were shipped to the amount of 100 tons from Beech hill, near Kentville, to the United States, to be used in the manufacture of paints and glass. According to the reports of the Department of Mines, a mineral classed as manganese was shipped from Wolfville in 1886 and 1887, but the mineral might be more properly classed as ochre. The locality from which it was taken is not mentioned. At Mount Uniacke, pyrolusite occurs in small pockets and veins in granite and in quartzite. The manganese is found in mineral paints at Bridgewater and at Chester Basin to the extent of 11 per cent of manganese peroxide in the former and 20 per cent in the latter.

A rather unique occurrence and one that has attracted attention in more recent years, is one that has been exploited near New Ross, Lunenburg. It lies 6 or 7 miles north of the village of New Ross and about a mile west of the north end of Wallaback lake.

[1] The ore occurs in a vein in a course-grained porphyritic biotite granite, which has been much denuded by glaciation. A band of quartzite, the only sedimentary rock in the vicinity, lies about a mile to the south. The vein is vertical, strikes N. 75° E., and is 2 to 28 inches thick. The wall rock is more or less decomposed. The vein at its outcrop was composed wholly of limonite; at a depth of

[1] Report of the Department of Mines, 1902, p. 67

feet it was a [1] mixture of specular iron and manganite, and a few feet deeper it passed into a mixture of manganite and pyrolusite.

Work began on this vein in 1898, and was carried on intermittently for four or five years. The coarser ore was hand-picked and the finer was concentrated with hand jigs, and it is claimed that 60 per cent of it was made practically free from iron, lime, and silica. It was mined to a depth of 112 feet and a length of 50 feet. The ore was of excellent quality and commanded a high price, but transportation was very expensive.

About 2 miles northeast of this vein another similar vein has been discovered, and two shafts about 30 feet deep have been sunk on it. The upper portion of this vein consists of hematite and limonite with some manganese ore. The proportion of manganese becomes much greater with depth, but the vein decreases in width. [2] The great abundance of manganese ore found in the drift in this district is indicative of other veins yet undiscovered.

Mineral Paint.

Paint deposits consisting of hydrated oxides of iron and manganese were at one time worked in different parts of the Province, but no work has been done for a number of years. [3] How (1868) in speaking of the paints of Kentville, says: "Brown bog iron and manganese of different shades, and yellow ochre are found in abundance at Beech hill, and 400 tons have been shipped to the United States within the last two or three years for the purpose of making paints and also for colouring glass." He states also that among the localities furnishing ochres, umbers, or wad are Chezzetcook and Jeddore, Petite Rivière, Chester, Bridgewater, and Montegan. At Chester Basin are several pits from which a mineral paint has been removed to a depth of 3 or 4 feet, and the deposit is by no means exhausted. The paint is of a rich brown colour, and according to How, consists of hydrated oxides of iron and manganese, with little lime and magnesia and probably a little silica. In one specimen he found as much as 20 per cent of peroxide of manganese. The lower Carboniferous rock in which it is found consists of limestone carrying oxides of iron and manganese, silica, organic matter, and pyrite. It is believed that the deposit was formed by the

[1] Faribault, Geol. Sur., Can., XV, 186 AA.
[2] Summary Report, Geol. Sur., Can., 1908, p. 154.
[3] Mineralogy of Nova Scotia, p. 100.

weathering of the limestone. At Frails cove, a short distance east of Chester, is also to be found some paint in rocks of the same age. A brown paint at Bridgewater was found by How to carry 11 per cent of peroxide of manganese. All these have proved to be very durable.

Iron.

Small deposits of bog iron ore have been reported from different localities, and as the slates are impregnated with pyrite, it is natural to expect the accumulation of hydrated oxides in low, swampy ground. None have been found of any great extent. [1] A number have been found along the slate belt stretching from Governors lake as far west as Hammond Plains. Another place where a deposit was found is Kingsbury, Lunenburg county.

Some deposits occur at the contact of the gold-bearing series with the overlying lower Carboniferous rocks. A 30 foot tunnel was driven on such a deposit on Annand brook, west of the north end of Shubenacadie-Grand lake. There is also [2] at Newton Mills, Colchester county, a deposit of red hematite lying at the contact of the Pre-Cambrian gold-bearing series with the lower Carboniferous. It passes upward into a grey, impure limestone, or at some points into a red calcareous conglomerate, containing pebbles of whin or other rocks. Several hundred tons have been taken from this deposit. The following analyses are given:—

	In sample as drawn.	In dried sample.
Peroxide of iron	69·97	69·14
Protoxide of iron	0·24	0·24
Bi-ulphide of iron	0·29	0·24
Oxide of manganese	trace	trace
Lime	0·49	0·50
Magnesia	0·28	0·28
Alumina	5·81	5·82
Silica	22·70	22·75
Phosphoric acid	0·02	0·02
Titanic acid	None	None
Carbonic acid	None	None
Combined water	0·94	0·95
Mixture	0·26	....
	100	100
Iron	48·50	48·63
Sulphur	0·15	0·16
Phosphorus	0·03	0·01

[1] Faribault. Geol. Sur., Can., XV, 176 AA
[2] Ann. Rep. Geol. Sur., Can., V, 182 P

Antimony.

WEST GORE.

Location.—An ore deposit that has assumed some importance is that of the auriferous stibnite at West Gore. The mine is situated in Hants county, 3 miles by wagon road southeast from Clarksville a station on the Midland division of the Dominion Atlantic railway.

Geology.—The rocks of the Halifax formation, which is here exposed, are light grey in colour, and are described by some as talcose. They are not well exposed in the immediate vicinity of the mines, but sections can be seen on Murdock brook, a short distance east, and along Glen brook, running some distance west of the mines. The strata strike northeast and dip southeast at an angle of about 45°. South of the mines is a 200 foot belt of rocks composed largely of quartzite. There has been considerable faulting. No igneous rocks are to be found near the deposit.

Character of the Deposit.—There are three veins, nearly parallel and running N. 55° W. The main vein is the middle one, and it lies about 1,000 feet from the vein to the southwest and about 700 feet from the one to the northeast. They occupy fault planes. The ore consists of stibnite, with which is associated native antimony, pyrite, mispickel, and coatings of kermesite and valentinite. The gangue consists of crushed slate, quartz, and a little calcite. The native antimony occurs throughout the ore zone in small stringers and bunches, and was found quite abundant on the sixth level. For a number of years it was believed that antimony was the only valuable product to be obtained from these veins, but a few years ago it was discovered that they also carry considerable gold, and the discovery enhanced the value of the deposits. [1] Two samples of ore analysed for the Department of Mines gave the following results:

	No. 1.	No. 2.
Antimony..	45·75%	18·21%
Gold..	2·48 ozs. per ton.	0·23 oz. per ton
Silver..	0·10 oz. "	0·13 oz. "

In the table of production is given the amount of gold that has been extracted from the antimony ore since 1905.

The ore-shoots are not well defined, but their general dip is in approximate accord with the dip of the strata. It is possible that the heavy body of quartzite immediately to the south helped to bring

[1] Report of the Department of Mines, 1899, p. 58

dent conditions favourable to the deposition of the ore. At the veins at the surface and the main vein at the 100 foot level were found to pinch out on [illegible] quartzite.

The southwest vein dips [illegible] 80 and is 2 to 20 inches thick with an average thickness of 4 [illegible]. The strata on the east side of the break are bent to the north and downward at an angle of 45 with the horizontal, while on the [illegible] side they curve in the opposite direction, showing the fault [illegible] [illegible]t-hand fault with the downthrow side on the west.

The northeast vein has [illegible] width of 5 inches.

The middle vein has b[illegible] 200 feet on the surface, and dips southwest 85°. [1]Th[illegible] ore [illegible] in lenses 50 to 60 feet in diameter and 6 to 24 inches [illegible] one le[illegible]s peters out, a few feet of drifting brings in [illegible] forms a shoot pitching southeast 45°. Th[illegible] [illegible]ar, and carries numerous stringers given o[illegible], while the hanging wall is well defined and [illegible] re as a rule clings closely to the hanging-wall, bu[illegible] in a[illegible] [illegible]ces it splits and one part passes to the foot-wall a[illegible]d follows [illegible] distance, while in some places the ore passes to the middle of the vein. At some depth the vein bifurcates and branches are given off on the northeast side that form a small angle with the main vein and run northwest and southeast. The one given off to the northwest carried some ore which was tapped by cross-cuts from the fifth level. The gold is not found free except where an interbedded vein of quartz enters at No. 1 shaft. A deposition of antimony ore is still going on. On the face of a cross-cut driven 100 feet from the vein a thin layer of sulphide of antimony was found, a small stream of water was [illegible], and the smell of sulphuretted hydrogen is quite perceptible. A soft red sulphide is also forming. This may be due to antimony being dissolved from the upper levels and redeposited at greater depth.

Mining, Milling, and Metallurgy.

Mining is carried on by shafts, levels, and overhand stopes.

The ore was cobbed and the high grade running over 40 per cent antimony was shipped; while the low grade, which contains

[1] Haley, D. F. Engineering and Mining Journal, Vol. 88, p. 723, Oct. 9, 1909.
Askwith, W. R. The West Gore Antimony Deposits. Trans. M[illegible] Soc., N.S. XI, p. 81.
Report of [illegible] Department of Mines, Nova Scotia, 1905, p. 69.

[illegible] antimony and gold and which comprised about [illegible]-tenths of the output, remained at the mine. The smelters do not give the full gold values. A concentrating plant was erected in 1907, and operated for a short time in 1908. [1] The flow sheet of the mill of the Dominion Antimony Company, Ltd., shows that the ore was crushed, sorted by trommels, and concentrated by compartment jigs. It was subjected to no metallurgical treatment in Nova Scotia. Experiments made by Brown, Mason, and Sexton on the treatment of auriferous antimony are recorded in the Report of the Department of Mines, Nova Scotia, 1905.

History and General Development

Antimony ore was found in the drift in 1880 by John McDougall on his own farm, and trenching was commenced with a view to discovering its source, but as the prospectors were working on the supposition that the vein was an interbedded one, much fruitless labour was expended. [2] During the autumn of 1883 a vein was found, the ore was reported to be of excellent quality and in economic amount and a large sample was shipped to Swansea. In 1884 two shafts, about 120 feet apart, were sunk 175 feet, levels were driven and 600 tons of No. 1 ore raised. Work continued the next year and for several years with varying success, but in 1892 the mine was closed. In 1887 the vein to the southwest was discovered by Gould Northup, and in 1899 the one to the northeast was discovered by John McDougal.

The most of the work in the district has been limited to the middle vein. This was reopened in 1899, closed again in the spring of 1900, and reopened in January, 1903. Several shafts were sunk on this vein, but only three were carried to any considerable depth. These are numbered 1, 2, and 3, beginning with the one farthest southeast and going northwest. No. 3 was carried to a depth of about 170 feet and No. 2, which is 220 feet southeast, was carried to a depth of 240 feet. No. 1, which is 150 feet southeast of No. 2, was sunk vertically 240 feet, a cross-cut was made to the vein and the shaft was then inclined along the vein, and a [illegible] at a greater angle from the vertical was made [illegible] the vertical section of the shaft. Levels were driven and the stoping carried to the southeast, keeping

[1] Report of the Department of Mines, Nova Scotia, 1907, p. 108.
[2] Ashworth, W. R., Trans. Min. Soc. N.S., Vol. VI, p. [illegible].
[3] Report of the Department of Mines, Nova Scotia, 1888, p. 21.

in touch with the main pay-shoot. The following table shows the extent of the workings in 1907, along with the work done that year[1]:—

No. of level.	Depth.	Present length.		Driven during the year.	
		East.	West.	East.	West.
1	113	122	160	0	0
2	228	44	160	0	78
3	318	182	432	0	182
4	410	342	763	0	246
5	492	290	179	0	0
6	586	18	269	0	22
7	662	57	447	0	190
8	769	124	200	124	200
Shaft	502 ft.	Sinking none.			
Winze	332 "	Sinking 150.			

The shaft was sunk 502 feet, and 257 feet southeast of the shaft a winze was sunk from the fifth level, and from this the sixth, seventh, and eighth levels were driven. The most of the ore that has been raised was taken from between the surface and the fifth level. [2]Operations were discontinued in the spring of 1908, but the St. Helen's Smelting Company commenced work in August, 1909, preparatory to reopening the mine acquired from the Dominion Antimony Company.

Little work has been done on the other two veins. [3]On the vein to the northeast a 55 foot shaft was sunk in 1899. With regard to the vein to the southwest commonly known as the Brook vein, the Report of the Department of Mines, Nova Scotia, for 1899, states that some first-class ore was taken out during the season, but work had ceased, and the report for 1906 states that the shaft was being unwatered for the purpose of sinking and driving.

Owing to the fact that only the high-grade ore was of commercial quality, much auriferous low-grade ore was not stoped out, and much of that which was stoped remains at the mine for further treatment.

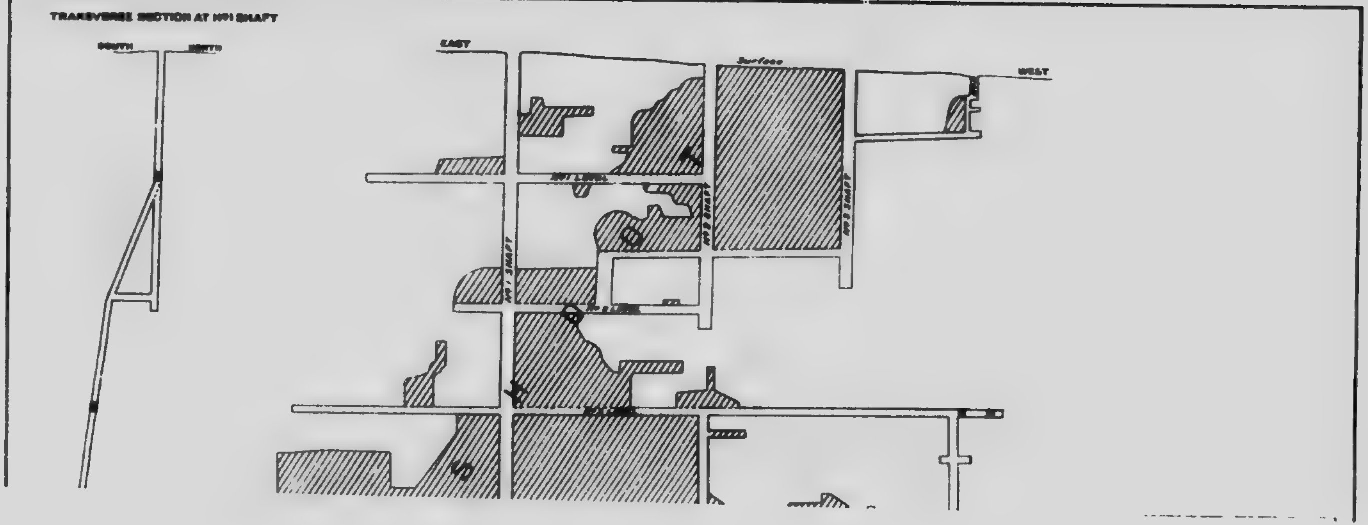
Float antimony ore has been found to the northwest and to the

[1] Report of the Department of Mines, Nova Scotia, 1907, p. 106.
[2] Report of the Department of Mines, Nova Scotia, 1908, p. 110.
[3] Report of the Department of Mines, Nova Scotia, 1899, p. 57.

Plate XLII.

Shaft house and new mill building, Dominion Antimony Co., West Gore.


WEST
Surface
EAST


TRANSVERSE SECTION AT No 1 SHAFT
SOUTH
NORTH
EAST
Surface
WEST
No 1 LEVEL
No 1 SHAFT
No 2 SHAFT
No 3 SHAFT
No 2 LEVEL

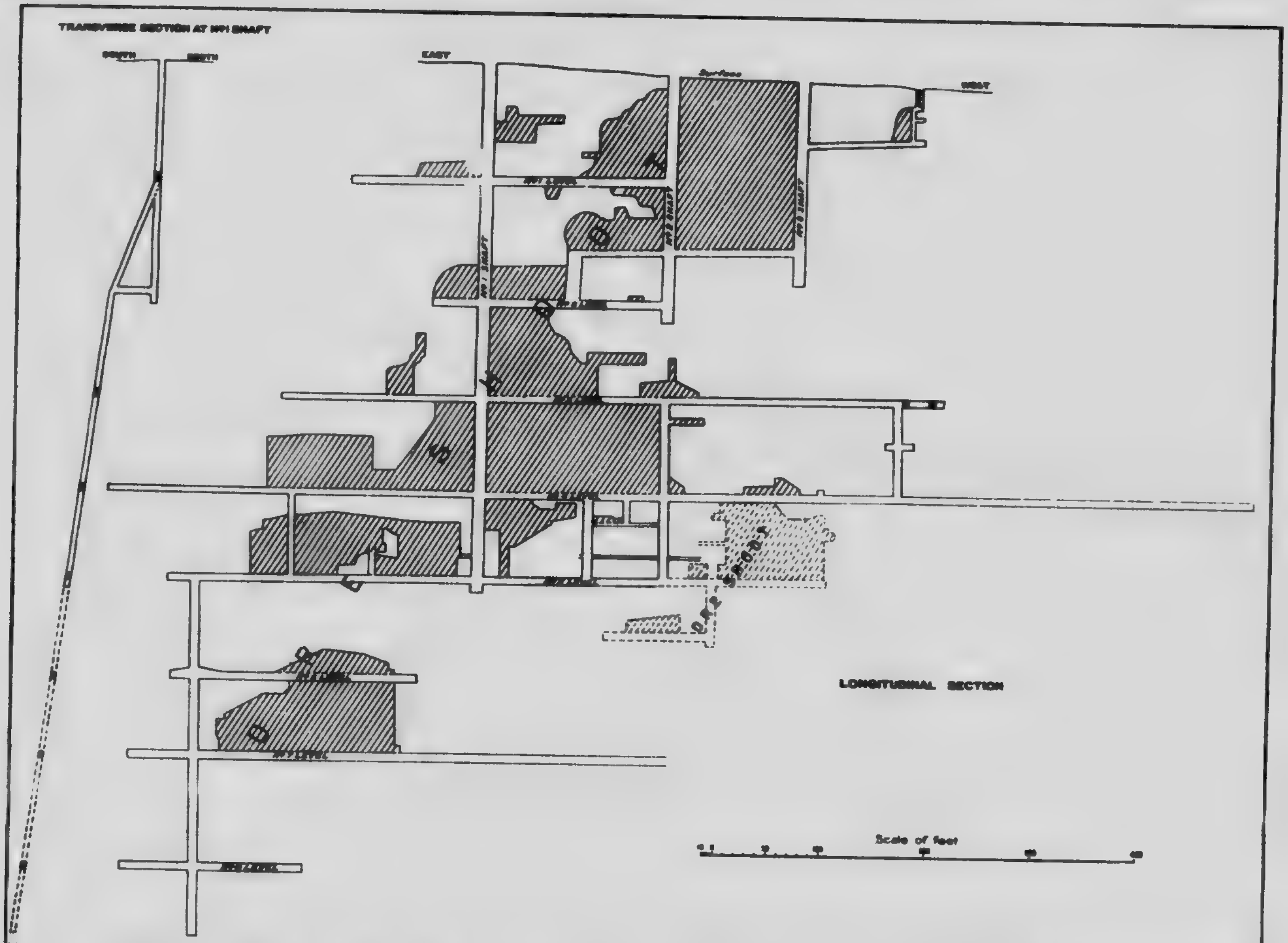


Fig. 21—THE MINE OF THE DOMINION ANTIMONY COMPANY, LTD.

WEST GORE

To accompany Memoir No. 20

sout
fron

vein

1884
1885
1886.
1887
1888.
1889
1890
1892
1905
1906
1907
1908

boro
grap
as t
coun
is q
Gasp
some

Hali
area
sheet
one
Chal

southeast of the mines, but much of it has probably been carried from the veins by workmen.

Antimony minerals have been detected in some of the auriferous veins of the Province.

PRODUCTION.

Year.	Tons.	Gold Oz.	Gold Dwt.	Gold Gr.
1884 (year ending Dec. 31)	463			
1885	758 (exported[1])			
1886	645			
1887	550			
1888	308 (exported)			
1889	30 "			
1890	265 (from dumps)			
1891	10 (exported)			
1905 (year ending Sept. 30)	4,000 (527 tons shipped)	1,232	16	23
1906	782	1,031	13	11
1907	3,042 (1,403 tons shipped)	1,319	18	12
1908	133	179	5	10

Graphite.

[1]Graphite has been reported from Musquodoboit and from Guysborough county. Much of the slate of the gold-bearing series is graphitic, but no place is known where the graphite so predominates as to assume economic proportions. Near Preston road, Halifax county, a shaft has been sunk 25 feet on a fault in which the gouge is quite graphitic. [2]Graphitic slates on the Halfway, Black and Gaspereau rivers in Kings county are in places so black as to attract some attention

Peat.

Peat-bogs are abundant in Guysborough, and also occur in Halifax, Queens, and Shelburne counties. Some of them have an area of over a square mile. Their distribution is shown on the sheets published by the Geological Survey of Canada on the scale of one mile to the inch, and the most important are mentioned by Chalmers,[3] who calculates that Nova Scotia and Cape Breton have

[1] Report of the Department of Mines, 1889, p. 13.
[2] Geol. Sur., Can., XIV, 215 A.
[3] Bulletin on Peat, Geol. Sur., Can., p. 9

250 square miles of bog averaging 8 to 10 feet in depth. The bogs of Nova Scotia have not yet been utilized.

Infusorial Earth.

Small deposits of infusorial earth are found in some of the lakes of Nova Scotia. [1]Beds 8 feet thick are found in Grand lake and Dartmouth lake, which supply Halifax with water. It is also found in [2]Sabody pond near Chester, and in Paint lake, 2 miles north of Head of Chezzetcook, and is reported from [3]Meteghan river, Digby county.

Fireclay.

[4]Some extensive deposits of fireclay have been discovered in the valley of the Musquodoboit river. Specimens submitted to Mr. G. C. Hoffmann, the chemist of the Survey, were pronounced on a preliminary examination to consist of mixed material. Mr. Hoffmann says of them: "Although apparently uniform (by reason of the whole being more or less coated with ferric hydrate), I found that some of the fragments when freed from this were fairly whitish in colour, and when burnt remained so, while other pieces were of a uniform greyish colour throughout, and when burnt assumed a reddish-brown colour."

Of these deposits Dr. Heinrich Ries writes[5]:—

A most remarkable clay deposit and one of undetermined age is that found at Shubenacadie and in the Musquodoboit valley. The material is a highly plastic clay, of whitish, dark grey, or mottled red and greyish-white colour, covered by a variable thickness of glacial drift . . . .

"Deposits are known to occur in the Musquodoboit valley between Middle Musquodoboit and Elmsvale, a distance of 6 miles, and beyond that, especially along Paint brook. The best known occurrence is on Murphy brook, near Middle Musquodoboit. The following records made by Mr. Keele indicate its mode of occurrence:—

"Section on property of Norman Deal, west bank of Paint brook, near Elmsvale P.O.:

[1] Gilpin. Mines and Mineral Lands of Nova Scotia, 1880, p. 115.
[2] Geol. Sur., Can., Ann. Rep. XVI, Part A, p. 346.
[3] Geol. Sur., Can., Ann. Rep. IX, Part A, p. 93.
[4] Summary Report, Geol. Sur., Can., 1894, p. 95.
[5] Journal of the Canadian Mining Institute, Vol. XIII

	Feet.	Inches.
Soil.	1	0
Bright red clay.	8	0
Mottled red and grey clay.	3	0
Grey sand.	1	0
Mottled red and grey clay.	8	0
Coarse dark red sand.	0	6
Mottled red and grey clay.	3	6
	25	0

"Sections on Murphy brook, near Middle Musquodoboit: No. I, 225 feet above G. T. Reed's house: No. II, 400 feet up-stream from No. I:

No. I.

	ft.	in.
Grey clay	17	0
Silty clay	4	0
Red and grey clay	1	0
	[illegible]	0

No. II.

	ft.	in
Red and grey clay.	20	0
Grey clay, sand, and lignite.	1	6
Dark grey clay	2	0
Red and grey clay.	1	6
	25	0

"From several borings on Murphy brook it is estimated that there may be a total thickness of not less than 50 feet of this clay.

"The clay, which is of fair refractoriness, burns to a cream colour, and hard body, its total fire shrinkage, even at cone 9, not being excessive. . . . .

"The material could be used in the manufacture of firebrick and pottery."

Further information regarding this deposit is found in Memoir 16—"The Clay and Shale Deposits of Nova Scotia and Portions of New Brunswick," by Heinrich Ries, assisted by Joseph Keele, published by the Geological Survey of Canada.

Should a railway be built through this section the deposit will no doubt prove of considerable economic value.

[1] Fireclay of good quality, non-calcareous, and fusible with difficulty, is reported about a mile southwest of Marshalltown church, Digby county.

[1] Ann. Rep. Geol. Sur., Can., Vol. IX, Part A, p. 91

Limestone.

It has been pointed out that in the neighbourhood of Chester there is a small area of rocks of lower Carboniferous age. The limestones occurring here were once of economic importance, and were quarried at Indian point, at Goat lake near Frails cove, and on the Second peninsula. [1] How describes the limestone at Indian point as of a deep blue colour, and yielding a lime which becomes hard and lasting as a cement. The rock was valued for building the arches of kilns, and lime from it was used in the construction of the Wellington barracks in Halifax, as it was of such a nature as to be of use in making concrete. A sample from Indian point, described as a "somewhat light grey, compact, massive limestone with, here and there, small inclusions of white crystalline calcite," was analysed by Mr. Wait of the Geological Survey, with the following results:—

(After drying at 100°C. Hygroscopic water 0·12 per cent).

Carbonate of lime		97·21
" magnesia		0·55
" iron		0·48
" manganese		0·58
Sulphate of lime	0·07	1·10
Alumina	0·41	
Silica, soluble	0·02	
Insoluble mineral matter	0·49	
Organic matter	0·11	
		99·92

A sample from Goat lake gave practically the same analysis.

A little gypsum was also found here, as mentioned in the chapter dealing with the rocks of lower Carboniferous age.

The limestone found on Preston road at the base of the Halifax formation was used for lime many years ago.

Granite.

Granite has been employed to a limited extent for structural work and for paving, and owing to its wide distribution it is found at many places where there are good shipping facilities. Several quarries have been worked southwest of the city of Halifax, and the granite has been used a great deal in the construction of the fortifications and of houses. Shelburne is favourably situated for exporting it, and at times as much as three shiploads a week have been

[1] Trans. N.S. Inst. Sc., 1866, p. 60.

taken out, but the demand fluctuates greatly. A mass east of Sherbrooke village is easily worked, and has been used in the construction of piers and abutments of iron bridges. The Halifax and Southwestern railway made use of this rock for bridges and culverts. Where granite boulders are abundant they are frequently split and used for the foundation of houses.

Slate.

In many places the slates show a good cleavage, and a little quarrying has been done. [1] "A small amount of flagstone has been quarried on the Northwest Arm of Halifax harbour, and at Beaver Bank. Slates were quarried to a small extent at Rawdon, and various places in Hants county, and the quality and quantity are equal to any demand." Slate was also quarried about 2 miles south of Kentville, and to a slight extent on Corbett brook.

[1] Gilpin, Minerals of Nova Scotia, 1901, p. 64

STATISTICS

Gold Production of the Province from 1862 to 1910

Year.	Material crushed.	Total gold extracted		
		Oz.	Dwt.	Gr.
1862	6,473	7,275		
1863	17,002	14,001	14	17
1864	21,434	20,022	18	13
1865	24,423	25,454	4	8
1866	32,162	25,204	13	9
1867	31,386	27,314	11	11
1868	32,262	20,541	6	10
1869	35,147	17,868	0	19
1870	30,829	19,866	7	5
1871	30,791	19,227	7	4
1872	17,093	13,094	17	6
1873	17,708	11,852	7	19
1874	13,844	9,140	13	9
1875	14,810	11,208	14	19
1876	15,490	12,038	13	18
1877	17,369	16,882	6	1
1878	17,990	12,577	1	22
1879	15,936	13,801	8	10
1880	14,037	13,234	0	4
1881	15,556	10,756	13	2
1882	12,081	14,107	3	20
1883	25,954	15,446	9	23
1884	25,147	16,059	18	17
1885	28,890	22,202	12	20
1886	29,010	23,362	5	13
1887	22,280	21,211	17	18
1888	30,178	22,407	3	10
1889	39,160	26,155	6	13
1890	42,749	24,358	9	9
1891	35,212	23,391	0	0
1892	33,633	21,080	3	18
1893 (9 months only)	28,040	14,030	5	7
1894	30,333	14,980	7	13
1895	58,082	22,112	17	21
1896	65,873	25,596	14	6
1897	76,569	26,579	19	21
1898	86,331	31,104	17	0
1899	104,122	27,772	2	3
1900	65,744	30,399	14	14
1901	87,992	30,537	4	0
1902	132,076	28,279	5	13
1903	92,645	25,198	4	18
1904	62,616	14,279	18	14
1905	71,725	15,549	14	6
1906	64,495	13,048	0	12
1907	64,657	13,687	6	20
1908	59,664	11,811	15	0
1909	59,058	12,597	12	13
1910	49,355	10,325	19	11
	2,080,403	919,046	19	14

[1] Rep. Dept. of Mines, N.S., 1909, XVIII.

Gold Production of the Province from 1862 to 1910 (Con[illegible]

Year	Material crushed	Total yield of gold		
Not included in previous totals, gold in stibnite ore from West Gore		Oz.	Dwt.	Gr.
1905	527	1,232	16	23
1906	783	1,031	13	11
1907	1,403	1,319	18	12
1908	133	179	5	[illegible]
1910	263	350	4	1
	2,088,1[illegible]	92[illegible]	18	[illegible]

Gold Production from 1862 to 1910 according to District.[1]

District	Ore crushed	Total yield of gold			Average yield per ton			Value of gold
	Tons	Oz.	Dwt.	Gr.	Oz.	Dwt.	Gr.	
Brookfield	93,527	38,709	2	2	0	8	7	[illegible]
Caribou and Moose River	210,242	57,785	12	22	0		[illegible]	[illegible]
Fifteenmile Stream	36,636	17,207	13	7	0	9	9	52[illegible]
ake Catcha	27,292	26,986	5	2[illegible]	0	19	20	512,[illegible]
Iolega Barrens	22,693	20,235	17	18	0	17	20	384,[illegible]
Iontague	29,482	42,149	1	6	1	8	14	800,8[illegible]
ldham	58,026	66,936	18	21	1	3	2	1,271,8[illegible]
Rawdon	12,189	9,606	5	10	0	15	18	182,[illegible]
enfrew	54,918	45,798	17	19	0	16	16	870,179
Salmon River	118,819	41,852	5	20	0	7	1	795,193
erbrooke	300,213	153,086	12	4	0	10	5	2,908,646
ormont	515,241	117,128	12	18	0	4	13	2,225,444
angier	55,060	25,322	13	19	0	9	5	481,131
niacke	63,331	43,982	17	17	0	13	21	835,675
averley	155,520	69,980	10	16	0	[illegible]	0	1,329,630
Vhiteburn	6,907	980	0	2	1	8	9	186,200
ine Harbour	77,306	34,992	15	11	0	9	1	664,863
her districts	142,476	74,610	7	7	0	10	11	1,417,597
	1,985,878	896,172	11	0	0	8	20	17,02[illegible]
ot included in above table) gold in stibnite of West Gore.								
5..	527	1,232	16	23	2	6	19	23,424
6..	783	1,031	13	11	1	6	8	19,602
7..	1,403	1,319	18	12		18	19	25,078
8..	133	179	5	0	1	6	23	3,406
0	263	350	4	15	1	14	12	6,654
	1,988,927	900,286	9	13				17,105,443

[1] Rept. Dept. of Mines, N.S., 1910, XIX.
‡ From 1869. / From 1882. = From 1883. † From 1886. * From 1887.

APPENDIX I.

LIST OF GLACIAL STRIÆ

Guysborough County.

1.	Near Canso road south of Threemile lake........	S. 17° W.
2.	Near Whitehaven road north of Spear lake......	S.
3.	East of junction of Whitehaven and Canso roads..	S. 7° E.
4.	Hog island, south of Port Felix..................	S. 15° E.
5.	Parker point, Chedabucto bay....................	S.
6.	Near Shore road, one-half mile west of Coddle harbour	S. 44° E.
7.	North of Shore road near East brook............	S. 25° E.
8.	South of Shore road, one-fourth mile east of Crook cove	S. 25° E.
9.	Two miles northwest of head of Gegogan harbour.	S. 29° E.
10.	West shore of mouth of St. Mary river..........	S. 14° E.
11.	Smith's peat bog near source of Hardwood Lake brook	S.

Halifax County.

1.	One-fourth mile north of school between Smith cove and Moser river	S. 10° E.
2.	One mile north of Harrigan Cove P.O..	S. 11° E.
3.	Snow island	S. 28° E.
4.	Quoddy hill southwest of Quoddy inlet............	S. 15° E.
5.	Three miles north of West River Sheet Harbour.	S. 49° E.
6.	Scraggy Lake narrows	S. 20° E.
7.	One mile southwest of Scraggy Lake narrows....	S. 26° E.
8.	Three-fourths mile west of Moose River Gold Mines	S. 2° E.
9.	Caribou mines	S. 70°
10.	Mooseland road, one mile north of Miller settlement	S. 46° E.
11.	Old Moose River road south of Brown lake......	S. 60 E.
12.	One-fourth mile north of point where Old Moose River road crosses Lindsay brook..............	S. 34° E.
13.	Island lake, 4 miles west of Gold Lake gold district	S. 37° E.
14.	Borgle island at the mouth of Ship harbour....	S. 20° E.
15.	Laybold island	S. 15° E.
16.	Black point off Clam harbour..................	S.
17.	" " " " "	S. 3° E.
18.	" " " " "	S. 33° E.
19	Two and a half miles north of the head of Clam harbour	S. 8° E.
20	and	S. 26° E.
21.	One mile north of Ship Harbour Lake P.O.....	S. 6° E.
22.	Half a mile south of Ship Harbour Lake P.O....	S. 2° E.
23.	One mile northwest of Ship Harbour Lake P.O..	S. 6° W.
24.	Peninsula between Western and Eastern arms of Jeddore harbour	S. 34° E.
25.	East side Dollar lake..............	S. 2° E.
26.	and	S.
27.	Antrim road, 1¼ miles northwest of Wyse Corner P.O.........	S. 28° E.
28.	Two miles south of Devon P.O.....................	S. 12° E.
29.	One and a half miles southwest of Carrols Corners P.O.........	S. 25° E.

9869—20½

30.	East side Petpeswick inlet opposite Porter point.	S. 8° E.
31.	One-fourth mile west of head of Petpeswick inlet.	S. 13° E
32.	One-half " " " " "	S. 8° E.
33.	One-fourth mile north of Rogers brook between Chezzetcook and Petpeswick lakes	S. 6° E.
34.	One mile northwest of Lake Catcha gold district.	S. 3° W.
35.	One mile south of Head of Chezzetcook P.O	S. 16° E
36.	One mile west of Porter Lake P.O	S. 20° E.
37.	Two miles west of Porter Lake P.O	S. 19° E.
38.	Two and a half miles west of Porter Lake P.O.	S. 15° E.
39.	Head of Lake No-good	S. 9° E.
40.	Philip head near mouth of Petpeswick inlet	S. 30° E
41.	Petpeswick Harbour P.O	S. 8° E.
42.	Casey point at mouth of Petpeswick inlet	S. 22° E
43.	Goose lake	S. 29° E.
44.	One mile south of Lawrencetown P.O	S. 24° E.
45.	One mile southwest of Lawrencetown P.O	S. 32° E.
46.	Sandy Cove station	S. 9° W.
47.	One mile northeast of Goff P.O	S. 12° E.
48.	One mile west of Goff P.O	S.
49.	One mile north of Montague gold district	S. 32° E.
50.	One and a half miles north of Montague gold district	S. 31° E.
51.	Head of Soldier lake	S. 27° E.
52.	One mile south of the last point mentioned	S. 26° E.
53.	Near head of Lake William	S. 34° E.
54.	One mile north of Waverley P.O	S. 24° E.
55.	One mile northeast of Wellington station	S. 3° E.
56.	Two miles north of Beaver bank	S. 27° E.
57.	One and a half miles north of Middle Beaver bank.	S. 20° E.
58.	Two miles northwest of Beaver bank	S. 43° E.
59.	Upper Sackville	S. 14° E.
60.	One-half mile south of Upper Sackville	S. 45° E.
61.	One-half mile northeast of Lucasville P.O	S. 64° E.
62.	Bedford	S. 48° E.
63.	Two and a half miles west of Bedford	S. 60 E.
64.	One mile west of Hammond Plains	S.
65.	One mile southeast of Lewis lake, Halifax and Windsor road	S. 26 E.
66.	Just south of South Uniacke gold district	S. 25° E.
67.	One and a half miles northwest of Preston Road P.O	S. 34° E.
68.	North end of Topsail lake	S. 45° E.
69.	On Preston road, 2 miles east of Dartmouth	S. 37 E.
70.	Dartmouth	S. 45° E.
71.	"	S. 55° E.
72.	"	S. 56 E.
73.	Halifax city	S. 13° E.
74.	"	S. 47° E
75.	"	S. 48° E.
76.	"	S. 52 E.
77.	Head of Kearney lake	S. 35 E.
78	One-half mile northwest of Mill Cove	S. 30 E.

Colchester County

1.	On Mountain road near boundary between Colchester and Halifax	S. 38 E.
2.	One and a half miles farther northeast on the same road	S. 20 E.
3	One-half mile east of Coldstream P.O	S. 35° E

Hants County

1	Near Fraser road, 1½ miles south of junction with [illegible] road	S. 72 E.

2. Just south of this is another.................... S. 40° E.
3. One and a half miles southeast of Gore mountain. S. 60° E.
4. and S. 50° E.
5. Two miles southeast of Gore mountain.......... S. 63° E.
6. Just east of crossroads at Gore mountain...... N. 65° E.
7. A little south of the last point mentioned...... N. 83° E.
8. A little south of the last point mentioned........ S. 68° E.
9. One-half mile south of Gore mountain.......... S. 71° E.
10. On Noel road, 2½ miles south of Gore mountain.. S. 72° E.
11. One mile west of last point...................... S. 74° E.
12. One and a half miles southeast of West Gore antimony mine .... S. 59° E.
13. Near Beaver Bank road, one-fourth mile north of boundary between Hants and Halifax.... S. 11° E.
14. One mile northeast of the last point mentioned.. S. 20° E.
15. Renfrew gold district .... S. 29° E.
16. One-fourth mile north of Mount Uniacke gold district...... .... S. 35° E.
17. Halifax and Windsor road, one-half mile north of boundary between Hants and Halifax........ S. 4° E.
18. One mile north of last point...................... S. 60° E.
19. One and a half miles northeast of Oland........ S. 35° E.
20. Long lake .... S. 56° E.
21 Three-fourths of a mile east of Central Rawdon Gol Mines .... N. 79 W.
22. One and a half miles northeast of Upper Newport. S. 55° E.

Lunenburg County.

1. Goetz cove, east of Mahone bay................ S. 42° E.

All the preceding are taken from the published map sheets, while the following are found in the Annual Report of the Geological Survey of Canada, Vol. IX, Part M, Appendix

Queens County.

1. Moose point. Coastal. On gneiss................ S. 20° E.
2. Somerville Centre. Coastal. On granite........ S. 18° E.
3. Mink island, Port Mouton. Coastal. On granite. S. 5° E.
4. Massacre island. Port Mouton. Coastal. On granite .... S. 5° E.
5. Port Joli harbour, east side. Coastal. On gneiss. S
6. Cadden bay. Coastal. On granite.............. S.
7. Port Joli head. Coastal. On gneiss.......... S. 5° E.
8. Port L'Hebert. Coastal. On gneiss.............. S
9. Shore opposite Coffin island. Coastal. On mica-slates .... S. 20° E.
10. Eagle Head breakwater. Coastal. On gneiss.... S. 10° E., S. 15° E.
11. Medway harbour, west side. Coastal. On gneiss .... S. 10° E., S. 15° E.
12. Buckfield. Interior.............................. S. 20° W.
13. Pleasant River road. Interior. On quartzite.... S. 35° E., S. 60° E.
14. Hills near Round lake, on summit. Interior...... S. 20° E.
15. South Brookfield. On quartzite.................... S. 10° E
16. North Brookfield. On quartzite..... .... S. 20° E.
17. Rosette. On slates.................... .... S. 40° E.
18. Port Medway river at crossing of Kempt Road. On slates .... S. 20° E., S. 30° W.
19. Kempt, near Annapolis post-road. On slates.... S. 10° E
20. Westfield. On slates............ .... S. 10° E
21. Pleasant River settlement, at crossing of New Elm road. On slates.......................... S. 34° E.
22. Dean lake. Port Medway river. On flat slates.. S.
23. North Brookfield. On slates. Exposures north.. S. 7 E.
24. Port Medway river below Dean lake. On flat slates........... .... S. 15 E

25. Port Medway river below Dean lake. Farther south. Two sets of striæ (1) on surface sloping to lake	S. 10° W.
(2) on level surfaces only	S. 18° E.
26. Port Medway river, south of McGowan lake, in Westfield, same as course of river	S. 3° W.
27. Horse lake, one mile east of Port Medway river and 1½ miles south of Westfield river	S. 2° W., S. 4° W.
28. Rossette road	S. 22° E., S. 2° W.

Shelburne County

1. Near Jones harbour. Coastal. On gneiss	S. 5° E.
2. Lockeport. Coastal. On quartzite	S. 10° E.
3. Jordan Ferry, half a mile below	S. 10 W.
4. Shelburne, on road to Ohio. Interior. On quartzite	S. 10° W.
5. Between Ohio and Clyde. Interior. On quartzite	S. 70 W.
6. Negro harbour, east side. Coastal. On quartzite.	S. 10 W.
7. Purgatory point. Coastal. On mica-slate	S.
8. Port Latour, opposite Jones island. Coastal.	S. and S.E.
9. Port Latour on road to Baccaro. Coastal. On quartzite	S. 10° E., S. 15° W.
10. Baccaro point. Coastal. On mica-slates	S.
11. Shag Harbour, at church. Coastal	S. 20° E.
12. Shelburne harbour, above Sand Point. Coastal. On mica-slate	S. 30° W.
13. Villagedale. Barrington bay. On gneiss	S. 15° W.
14. Upper Port Latour, opposite John island. On quartzite	S. 20° W.
15. Cape Negro island, eastern end. On mica-schist	S. 25° W.

Yarmouth County

1. Wellington. On grey mica-schist	S. 50° W.
2. Yarmouth city. On grey mica-schist	S. 35° W.
3. Pubnico harbour, at head. On grey mica-schist	S. 40° W.

Digby County

1. Digby Neck, on road to Broad cove. South side of trap range	S. 5° E.
2. Petite Passage. On side of bluff looking east	S. 50 W.
3. Petite Passage. At Israel cove, crossing top of trap columns 10 feet above high-water	S. 60° W.

Annapolis County

1. Fairy lake, at the Pictured Rocks. The first record is in small lines, the second in furrows.	S. 2° W., S. 10 W.
2. Fairy lake, at Mill Cove. On slates	S. 10° W.
3. Fairy lake. On shore. (General course of lake.)	S. 6° W.
4. West Nictaux. On slates. Exposures north	S. 10° E.
5. Roxbury. (South of Lawrencetown). On summit of South mountain. Rock granite	S. 20° W.
6. Virginia settlement. On Silurian slates	N. 4° W.

BIBLIOGRAPHY.

1829—HALIBURTON, THOMAS C.

An Historical and Statistical Account of Nova Scotia. Halifax. Geology and Mineralogy in Vol. II, pp. 414-453.

Rocks of the gold-bearing series were believed to be trap rock and clay slate, the former 'sometimes apparently interstratified with the clay slate, but generally in confused masses.'

1832—JACKSON, CHARLES T. and ALGER, FRANCIS.

Remarks on the Mineralogy and Geology of Nova Scotia. Memoir of the American Academy of Arts and Science. New Series I, pp. 217-330.

Deals chiefly with the trap rock of North mountain. Last few pages devoted to the slate and quartzite of the Atlantic coast. Accompanied by a geologically coloured map.

1836—GESNER, ABRAHAM.

Remarks on the Geology and Mineralogy of Nova Scotia. Halifax. 272 pp.

Discusses the geology of the Province, making four divisions: Primary district; Clay Slate district; Red Sandstone district including the coal fields; and the Trap district. Describes the rocks outcropping in different localities. Is accompanied by a coloured geological map.

1849—GESNER, ABRAHAM.

The Industrial Resources of Nova Scotia. Comprehending the Physical Geography, Topography, Geology, Agriculture, Fisheries, Mines, Forests, Wild Lands, Lumbering, Manufactories, Navigation, Commerce, Emigration, Improvements, Industry, Contemplated Railways, Natural History and Resources, of the Province. Halifax. pp. 341.

1855—DAWSON, J. W.

Acadian Geology. An account of the Geological Structure and Mineral Resources of Nova Scotia, and Portions of the Neighbouring Provinces of British America. Edinburgh. pp. XII-388.

Treats of modern alluvial deposits, the 'New Red Sandstone,' the Carboniferous, Devonian, and Silurian systems and the metamorphic district of the Atlantic coast. The last chapter is concerned with a discussion of the geology and the age of the rocks of this metamorphic district. Accompanied by a geological map.

1861—MARSH, O. C.

The Gold of Nova Scotia. Am. Jour. Sc. 2nd. Series. XXXII, pp. 394-400.

1861—DAWSON, J. W.

On the Recent Discoveries of Gold in Nova Scotia. Canadian Naturalist. VI, pp. 417-430.

1862—CAMPBELL, J. S. and POOLE, H.

Report on the gold fields: eastern section by Campbell, western section by Poole.

Additional papers on the Nova Scotia gold fields including Messrs. Poole and Campbell's reports.

(A report to the Commissioner of the Crown Lands Department) Halifax, 36 pp. Mr. Poole's report, pp. 4-22; Mr. Campbell's report, pp. 29-36. Same Jour. of Assembly, 1862. App. No. 2, 33-68.

1862—POOLE, HENRY.

Report on the gold fields, western section. Halifax, pp. 25

1863—CAMPBELL, J.

Nova Scotia Gold Fields. (To the Honourable Joseph Howe, Provincial Secretary). Halifax, p. 12.

Divides the gold-bearing rocks into two groups, slate and quartzite, describes the folding, discusses the question of alluvial deposits, and gives the result of explorations. Accompanied by a cross section.

1864—SILLIMANN, B., Jr.

On the so-called 'barrel quartz' of Nova Scotia. Am. Jour. Sc. 2nd Series, XXXVIII, 104-106.

1864—SILLIMANN, B., Jr.

Report on the Gold Property of the New York and Nova Scotia Gold Mining Company with an Introduction on the General Structure and Geology of the Nova Scotia Gold Fields. New York, pp. 56.

In the introduction is a careful consideration of the general and economic geology of the gold fields. This is followed by a general description of the property owned by the New York and Nova Scotia Gold Mining Company and details regarding the treatment of the ores.

1865—LOGAN, W. E.

Atlas of maps and sections to accompany Report of Progress, Geological Survey, Canada, from its commencement to 1863.

1866—LOGAN, W. E. and HALL, J.

Geological map of Canada and part of the United States from Hudson bay to Virginia, and from the Missouri river to Newfoundland.

1866—LOGAN, W. E.

Geological map of Canada and adjacent regions. 25 M.=1 inch.

1868—DAWSON, J. W.

Acadian Geology, 2nd edition, revised and enlarged, with a geological map and numerous illustrations. London, Edinburgh, Halifax, and Montreal. pp. XXVII-694.

1868—HUNT, T. STERRY.

Report on the Gold Region of Nova Scotia. Geol. Sur., Can., 1868, pp. 48.

Deals with the geology of the fields, the nature and origin of the auriferous veins, the method of treating the ore, and the structural and economic geology of the different districts.

1868—HEATHERINGTON, A.

A Practical Guide for Tourists, Miners, and Investors and All Persons Interested in the Development of the Gold Fields of Nova Scotia. Montreal. 170 pp.

Contains a succinct account of the discovery of gold in the Province, a brief chapter on each proclaimed district, in which is given its location, history, development, and relative importance. Synopses of geological reports are given, descriptions of metallurgical treatment, and tables of statistics.

1868—HOW HENRY.

The mineralogy of Nova Scotia, a Report to the Provincial Government. Halifax. pp. 216.

Describes the mineral resources of the Province. Pages 37-57 deal with the character of the gold deposit along with a short paragraph on each mining district, noting its status

1869—HIND, H. Y.

Report on the Waverley Gold District, with Geological Maps and Sections. Halifax. pp. 62.

Discusses the structural geology of the district, the structure of the leads with the distribution of the gold, and the identification of gold-bearing groups of leads in different districts. Accompanied by a plan on the scale of 600 ft. 1 inch.

1869 HIND, H. Y.

Notes on the Structure of the Nova Scotia Gold District. Trans N.S. Inst. Nat. Sc. II, Part 3, pp. 102-109

1870 HIND, H. Y.

On Two Gneissoid Series in Nova Scotia and New Brunswick, supposed to be the Equivalents of the Huronian (Cambrian) and Laurentian. Quart. Jour. Geol. Soc. London, XXVI, pp. 468-479. Map.

1870—HIND, H. Y.

On the Laurentian and Huronian Series in Nova Scotia and New Brunswick. Am. Jour. Sc. 2nd Series, XLIX, pp. 347-355

1870 HIND, H. Y.

Report on the Sherbrooke Gold District together with a Paper on the Gneisses of Nova Scotia and an abstract of a paper on Gold Mining in Nova Scotia. Halifax. pp. 79.

In the paper on the gneisses he considers the granite as metamorphosed sediments of Laurentian age and the gneisses and schists in contact with the granite as Huronian. The report on Sherbrooke includes a classification of the veins and a theory of their origin. Attention is called to the loss of gold in the sulphides in the tailings. Large scale plans and sections accompany the report.

1872.—SELWYN, A. R. C.

Notes and Observations on the Gold Fields of Quebec and Nova Scotia. Geol. Sur., Can. Report of Progress. 1870-71, pp. 252-282.

Treats of the geology and age of the series, also of the origin and age of the veins, of the causes of the depression in the industry, and of the probability of the occurrence of profitable placers. As opposed to Hunt and Hind he maintains the veins are later than the rocks.

1872 HIND, H. Y.

Report on the Mount Uniacke, Oldham, and Renfrew Gold Mining Districts, with Plans and Sections. Halifax, pp. 136.

The general remarks deal with the metallurgical treatment of the ores, the distribution of the gold in the veins as shoots or chimneys; and the profitable mining of low-grade belts. There is a section of the report devoted to each of the three districts, in which is given a history of the district as compiled from the Chief Commissioner's reports, a description of the geology and of the leads worked.

1878—DAWSON, J. W.

Acadian Geology. The Geological Structure, Organic Remains, and Mineral Resources of Nova Scotia, New Brunswick, and Prince Edward Island. Third edition. London.

Well-written and much referred to by geologists of to-day. Gives the results of investigations in the gold fields, and contains a supplement in which is a discussion of the age of the gold-bearing series.

1879—POOLE, HENRY S.

Report on the Inspection of Mines in Nova Scotia, for the year ending December 31, 1878.

Report of the Department of Mines, Nova Scotia, for the year 1878. Halifax.

Pages 20-28 contain a strong and convincing argument in favour of the theory that the auriferous veins are of later age than the rocks.

1880—GILPIN, EDWIN, Jr.

The Mines and Mineral Lands of Nova Scotia. Halifax. pp. 127. Treats concisely of the mineral deposits of the Province. Gold fields, pp. 30-51.

1880—POOLE, H. S.

The Gold Leads of Nova Scotia. Quart. Jour. Geol. Soc. London, XXXVI, 307-313.

1881—MURRAY, A. and HOWLEY, J. P.

Geological Survey of Newfoundland. London. pp. 145, 146, 167. A consideration of the age of the rocks.

1882—GILPIN, EDWIN, Jr.

The Gold Fields of Nova Scotia. Transactions of the North of England Institute of Mining and Mechanical Engineers. XXI, 1881-82.

A treatment of the geology, the character of the ore deposits, mining, milling, and metallurgy. Accompanied by map, plan of Waverley district, and five plates.

1882—GILPIN, EDWIN, Jr.

The Gold Fields of Nova Scotia, Eng and Min. Journal. XXXIV, 5-6, 17-18.

1886—GILPIN, EDWIN, Jr.

The Nova Scotia Gold Mines. Trans. Am. Inst. Min. Eng. XIV, 674-689.

1886—FARIBAULT, E. R.

Report on the Lower Cambrian Rocks of Guysborough and Halifax Counties, Nova Scotia. Geological and Natural History Survey, Canada, Annual Report (New Series), Vol. II. 1886. Part P, pp. 129-163.

A consideration chiefly of the geology of the area described.

1888—GILPIN, EDWIN, Jr.

Notes on the Nova Scotia Gold Veins. Transactions of the Royal Society of Canada, Vol. VI, Section IV, pp. 63-70.

Discusses the geology and the origin of the gold.

1891—WESTON, T. C.

Notes on Concretionary Structure in Various Rock Formations in Canada. Trans. N. S. Inst. Sc. VIII, 137-142.

1891—WALCOTT, C. D.

Correlation Papers, Cambrian. Bulletin of the United States Geological Survey, No. 81, pp. 56-59, 262, 380.

1892—VAN HISE, C. R.

Correlation Papers, Archean and Algonkian. Bulletin of the United States Geological Survey, No. 86, pp. 239-247, 503.

1893—THOMAS, W. R.

Notes on Practical Mining Applicable to some Gold Mining Districts in Nova Scotia. Trans. Min. Soc. N. S. II, Pt. 3, pp. 99-109.

1893—HARDMAN, JOHN E.

Recent Gold Milling Practice in Nova Scotia. Transactions of the Mining Society of Nova Scotia, Vol. I, Part II, pp 34-44. With plans and elevations.

1894—WOODHOUSE, ALFRED.

The Occurrence and Reduction of Gold. Transaction of the Mining Society of Nova Scotia, Vol. II, Part I, pp. 15-26.

1894—HARDMAN, J. E.

Government Aid to Mining—A Suggestion. Transactions of the Mining Society of Nova Scotia, Vol. II, Part III, pp. 110-114.
Suggests detailed topographical maps of each prominent gold district, with accompanying monographs in pamphlet form.

1894—MASON, F. H.

Gold Chlorination. A Description of the Newbury Vautin Process. Transactions of the Mining Society of Nova Scotia, Vol. II, Part IV, pp. 152-157. With two plates.

1895—PREST, W. H.

Deep Mining in Nova Scotia. The Proceedings and Transactions of the Nova Scotian Institute of Science, Halifax, Nova Scotia, 1890-94. Vol. VIII (Vol. I of the Second Series) pp. 420-434.

1895—RUTHERFORD, JOHN.

Gold Mining in Nova Scotia—A Review of Operations in the Various Localities. Transactions of the Mining Society of Nova Scotia. Vol. III, pp. 125-135.

1895—BECKER, GEORGE F.

Reconnaissance of the Gold Fields of the Southern Appalachians. United States Geological Survey. Extract from the Sixteenth Annual Report of the Director, 1894-95.
Pages 74-82 discuss the age of the rocks and the origin of the gold in Nova Scotia.

1895—HARDMAN, J. E.

On the Relative Costs of Mining Narrow Veins. Hand Drills vs. Air Drills. Transactions of the Mining Society of Nova Scotia, Vol. III, pp. 55-59.

1895—WILSON, B. C.

Some Remarks on the Gold Production of Nova Scotia and How it May be Increased. Transactions of the Mining Society of Nova Scotia. Vol. III, pp. 60-65.

1895—BAILEY, L. W.

Preliminary Report on Geological Investigations in Southwestern Nova Scotia. Geol. Sur., Can., VI, Part Q.

1896—CHALMERS, ROBERT.

Surface Geology of Eastern New Brunswick, Northwestern Nova Scotia, and a Portion of Prince Edward Island. Geological Survey, Canada. VII, Part M, pp. 149.
Pages 95-97 treat of glaciation of South and North mountains, claiming that the glaciation of the peninsula of Nova Scotia was local.

1897—HARDMAN, J. E.

Gold Mining Industries. Nova Scotia. The Canadian Mining Iron and Steel Manual, 1897. Compiled by B. T. A. Bell. pp. 112-117, Ottawa.
A concise review of the industry.

1897—ANDREWS, C. F.

Notes on the Mining of Low Grade Gold Ore in Nova Scotia. The Journal of the Federated Canadian Mining Institute. Vol. 2, pp. 5-12. Two plates.

1898—PREST, W. H.

Glacial Succession in Central Lunenburg. Trans. N.S. Inst., IX, 158-170.
Gives sections.

1898 GILPIN, EDWIN, Jr.

Ores of Nova Scotia. Gold, Lead, and Copper. Halifax.
Notes the method of occurrence, gives historical sketch of each district, and details of the costs of mining, also a contribution by F. H. Mason on 'Concentrates.'

1898 MASON, F. H.

'Concentrates.' Ores of Nova Scotia. Gold, Lead, and Copper by E. Gilpin, pp. 33-38.
Emphasizes the necessity of adopting methods of recovering the gold not amenable to amalgamation.

1898 BAILEY, L. W.

Report on the Geology of Southwest Nova Scotia, Embracing the Counties of Queens, Shelburne, Yarmouth, Digby, and Part of Annapolis. Geological Survey, Canada. Annual Report (New Series), Vol. IX, 1896. Part M.
Describes the glacial geology and the topography of the part studied. Subdivides the gold-bearing series into a lower quartzite and two slate divisions and describes sections of these. Examines the schists and gneisses with a view to the determination of the age of the rocks at Yarmouth. Finds it impossible to mark the line of separation from the overlying Devonian rocks. Gives a few notes on the gold districts of the southwest.

1899—HAYWARD, A. A.

Rapid Sinking in a Nova Scotia Gold Mine. Transactions of the Mining Society of Nova Scotia, Vol. IV, pp. 40-49.

1899—LIBBEY, W. L.

Mining and Milling costs in Queens County, N.S. Transactions of the Mining Society of Nova Scotia, Vol. IV, pp. 51-56.

1899—WOODMAN, J. E.

Studies in the Gold-Bearing Slates of Nova Scotia. Proceedings of the Boston Society of Natural History, Vol. 28, No. 15, pp. 375-407. Boston.

1899 FARIBAULT, E. R.

On the Gold Measures of Nova Scotia and Deep Mining. The Journal of the Canadian Mining Institute, Vol. II, 1899, pp. 119-128. With diagrams, maps, and a section.
Republished with an introduction by Gilpin in pamphlet form by the Mining Society of Nova Scotia.
Gives a concise description of the geology of the gold fields, of the character of the ore deposits and their intimate relation to the general rock structure.
Owing to the apparent dependence of the ore deposition on peculiarities of rock structure and the similarity existing between the reefs of Bendigo and the veins of Nova Scotia, he strongly advises the adoption of a policy of deep mining.

1899 PIERS, W. H.

Deep Mining and Permanence of Paystreaks in Nova Scotia. Eng. and Min. Jour., LXVII, 495-496.

1899—STUART, G. W.

Nova Scotia Gold Mines. Eng. and Min. Jour., LXVII, 292.

1899—SELWYN, A. R. C.

Gold Mining in Nova Scotia from 1860 to 1899. Jour. Can. Min. Inst., II, 162-165.

1899—WILLIS, C. E.

A Peculiar Lode Formation. Trans. Min. Soc. N. S., IV, 22-26.

1900—STUART, G. W.

An Incident in Systematic Prospecting Connected with the Discovery of the Rose Lead, Montague, N.S. Trans. Min. Soc., N.S. Vol. V, 25-27.

1900—WILSON, B. C.

What Becomes of the Gold Run Out in the Tailings. Trans. Min. Soc., N.S. Vol. V, 63-78.

1900—STUART, GEO. W.

Gold Mining in Nova Scotia. The Engineering and Mining Journal, LXX, pp. 309-311.

1901—ASKWITH, W. R.

The West Gore Antimony Deposits. Transactions of the Mining Society of Nova Scotia, Vol. VI, pp. 80-86. Plan and section.

1901—DALY, R. A.

The Physiography of Acadia. Bulletin of the Museum of Comparative Zoology at Harvard College, Vol. XXXVIII. Geological Series, Vol. V, No. 3. With eleven plates.

1901—GILPIN, EDWIN, Jr.

The Minerals of Nova Scotia. Halifax.

1903—FARIBAULT, E. R.

Deep Gold Mining in Nova Scotia. Report on the Best Methods of Testing the Value of the Deeper Gold Deposits of Nova Scotia. Halifax.

Classifies the veins of the different districts, and gives suggestions as to how the government may secure the best results in the assistance offered to test the possibilities of deep mining. The appendix shows that there are auriferous veins which do not come to the surface at all. The report is accompanied by a number of sections.

1903—McLEOD, R. R.

Markland or Nova Scotia: Its History, Natural Resources, and Native Beauties.

Gives a history of each county and an account of the resources and industries.

1904—FORBES, H. L.

Chlorination of Gold Ore of North Brookfield Mine. Trans. Can. Min. Inst., VII, pp. 308-318.

1904—McNULTY, J. G.

Observations on Gold Milling. Transactions of the Mining Society of Nova Scotia, Vol. VIII, pp. 96-10[illegible].

1904—O'SHAUGHNESSY, M. R.

Stamp Milling Practice in Nova Scotia, and the advantage of Introducing Water under Pressure below the Crushing Surfaces in the Gold Stamp Mill. Transactions of the Mining Society of Nova Scotia. VIII, pp. 110-122.

1904—WOODMAN, J. E.

Nomenclature of the Gold-Bearing Metamorphic Series of Nova Scotia. Am. Geol. XXXIII, pp. 364-370.

1904—WOODMAN, J. E.

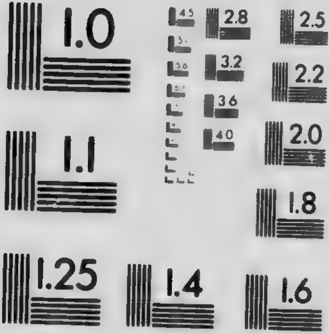
The Sediments of the Meguma Series of Nova Scotia. The American Geologist, Vol. XXXIV, July, 1904.

1904—WOODMAN, J. E.

Geology of the Moose River Gold District, Halifax County, Nova Scotia. Proceedings and Transactions of the Nova Scotian Institute of Science, Vol. XI, Part I, pp. 18-88.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc

1653 East Main Street
Rochester, New York 14609 USA
(716) 482-0300 Phone
(716) 288-5989 Fax

A detailed description of the geology and of the character of the ore deposits. Well illustrated and accompanied by large scale plans and sections.

1905—WOODMAN, J. E.

Distribution of Bedded Leads in Relation to Mining Policy. Proceedings and Transactions of the Nova Scotian Institute of Science, Vol. XI, Part 2, pp. 163-178.

1905—LIBBEY, W. L.

Government Aid to Deep Gold Mining in Nova Scotia. Transactions of the Mining Society of Nova Scotia, Vol. IX, pp. 54-60.

1905—LIBBEY, W. L.

The Cost of Plant, Shaft Sinking, and Level Driving in the Deepest Levels Yet Reached in the Gold Mines of Nova Scotia. Transactions of the Mining Society of Nova Scotia, Vol. IX, pp. 94-96.

1907—FULTON, T. T.

On the Lixiviation of an Auriferous Arsenopyrite Concentrate by Cyanide. Transactions of the Mining Society of Nova Scotia, Vol. X, pp. 97-118.

1908—WOODMAN, J. E.

Probable Age of the Meguma (Gold-Bearing) Series of Nova Scotia. Bulletin of the Geological Society of America, Vol. XIX, pp. 99-112. Three plates.

1908—MATTHEW, G. F.

Geological Cycles in the Maritime Provinces of Canada. Transactions of the Royal Society of Canada, Third Series, 1908-1909, Vol. II, Section IV, pp. 121-143.

1908—MOORE, PHIL. H.

Mine Pumping with Direct Connected, Electrically Driven Turbine Pumps. Transactions of the Mining Society of Nova Scotia, Vol. XII, pp. 1-9.

1908—BROWN, E. PERCY.

The Development of an Ore Shoot in Nova Scotia. Transactions of the Mining Society of Nova Scotia, Vol. XII, pp. 57-61. With sections.

1908—MACKENZIE, T. G.

Notes on the Mining Property of the Seal Harbour Mining Company. Transactions of the Mining Society of Nova Scotia, Vol. XII, pp. 63-81.

1908—STUART, GEO. W.

Some of the Causes of the Present Condition of Gold Mining in Nova Scotia. Transactions of the Mining Society of Nova Scotia, Vol. XII, pp. 85-90.

1909—BROWN, E. PERCY.

Notes on the Geological Structure at the Richardson Mine as Shown by Plans and Models of the Same. Transactions of the Mining Society of Nova Scotia, Vol. XIII, pp. 17-26. With plates.

1909—RONNAN, FRED. P.

A Practical Suggestion for Testing the Gold Mines of Nova Scotia. Transactions of the Mining Society of Nova Scotia, Vol. XIII, pp. 27-32.

1909—HALEY, D. F.

The Auriferous Antimony Ore of West Gore, Nova Scotia. Eng. and Min. Jour., Vol. 88, pp. 723-724.

1909—BROWN, E. PERCY.

How Can the Gold Mining Industry of Nova Scotia be Assisted. Transactions of the Mining Society of Nova Scotia. Vol. XIII, pp. 33-37.

1909—BADGER, H. S.

Methods of Ore Handling at the Richardson Mines, Guysborough County, Nova Scotia. Transactions of the Mining Society of Nova Scotia, Vol. XIII, pp. 83-97. One plate.

HONEYMAN, D.

Numerous contributions to the Nova Scotian Institute of Science from 1867 to 1887. These are chiefly of the nature of notes on geological excursions.

FARIBAULT, E. R.

The Summary Reports of the Geological Survey of Canada for the years from 1887 to the present, give the results of field operations. Important and somewhat detailed descriptions of the individual gold districts are found in the Summary Reports subsequent to 1896.

RONNAN, F. P.

A series of interesting articles on individual gold districts in the *Industrial Advocate*, beginning during the year 1896 and continuing through several volumes.

Reports of the Chief Gold Commissioner for the Province of Nova Scotia for the years 1862 and 1863.

Reports of the Chief Commissioner of Mines for the Province of Nova Scotia for the years 1864-1871.

Reports of the Department of Mines for the Province of Nova Scotia for the years 1872-1909.

These reports contain much valuable information of a general character, as well as details of progress made in the different districts, and statistics.

BAILEY, L. W.

Summary Reports of the Geological Survey, Canada, for 1891, 1893, 1895, and 1896. These give notes on the field work.

List of Maps, Plans, and Sections of the Gold Fields of Nova Scotia, published by the Geological Survey of Canada.

General Maps.

362. Southwestern Nova Scotia, Scale, 8 miles to 1 inch. Part Q, Vol. VI.
378. Part of Guysborough County. Sheet II, S.W. Scale, 4 miles to 1 inch. Part P, Vol. II.
641. Western Nova Scotia. Scale, 8 miles to 1 inch. Part M, Vol. IX.
757* Index Map of Nova Scotia. Scale, 25 miles to 1 inch. Part A, Vol. XIV.
764. Geological Sketch Map of parts of Kings and Hants counties, N.S. Scale, 2 miles to 1 inch. Part A, Vol. XIV.
927. Gold Fields of Nova Scotia. This is also an index to the maps of the Province.

Serial Geological Sheets.

(Scale 1 mile to 1 inch.)

379. Sheet 25. Guysborough Sheet.
380. Sheet 26. Whitehaven Sheet.
381. Sheet 27. Isaac Harbour Sheet.
382. Sheet 28. Gegogan Sheet.

* Out of print.

383. Sheet 29. Sherbrooke Sheet.
384. Sheet 30. Country Harbour Sheet.
390. Sheet 36. West River St. Marys Sheet.
550. Sheet 37. Liscomb River Sheet.
551. Sheet 38. Moser River Sheet.
565. Sheet 39. Tangier Sheet.
592. Sheet 40. Sheet Harbour Sheet.
607. Sheet 41. Fifteenmile Stream Sheet.
593. Sheet 42. Trafalgar Sheet.
633. Sheet 48. Eastville Sheet.
634. Sheet 49. Upper Musquodoboit Sheet
624. Sheet 50. Moose River Sheet.
611. Sheet 51 (and 52) Ship Harbour Sheet
700. Sheet 53. Lawrencetown Sheet.
807. Sheet 54. Musquodoboit Harbour Sheet.
908. Sheet 55. Gays River Sheet.
635. Sheet 56. Shubenacadie Sheet.
878. Sheet 65. Kennetcook Sheet.
1005. Sheet 66. Elmsdale Sheet.
1025. Sheet 67. Waverley Sheet.
1019. Sheet 68. Halifax Sheet. Black.
985. Sheet 69. Prospect Sheet.
1043. Sheet 70. Aspotogan Sheet.
1036. Sheet 71. St. Margaret Bay Sheet.
1037. Sheet 73. Windsor Sheet.
1133. Sheet 84. Kingsport Sheet.

Plans and Sections of Gold Districts.

832. Isaac Harbour (Goldboro), Guysborough county. Scale, 500 feet to 1 inch.
656. Upper Seal Harbour, Guysborough county, Richardson Mine. Scale, 500 feet to 1 inch.
649. Forest Hill, Guysborough county. Scale, 500 feet to 1 inch.
843. Cochrane Hill, Guysborough county. Scale, 500 feet to 1 inch.
867. Wine Harbour, Guysborough county. Scale, 250 feet to 1 inch.
645. Goldenville, Guysborough county. Scale, 250 feet to 1 inch.
945. Harrigan Cove, Halifax county. Scale, 100 feet to 1 inch.
647. Salmon River, Halifax county. Scale, 250 feet to 1 inch.
650. Fifteenmile Stream, Halifax county. Scale, 500 feet to 1 inch.
622. Killag, Halifax county. Scale, 500 feet to 1 inch.
643. Caribou, Halifax county. Scale, 500 feet to 1 inch.
646. Moose River, Halifax county. Scale, 250 feet to 1 inch.
648. Mooseland, Halifax county. Scale, 250 feet to 1 inch.
773. Tangier, Halifax county. Scale, 250 feet to 1 inch.
765. Lake Catcha, Halifax county. Scale, 250 feet to 1 inch.
666. Lawrencetown, Halifax county. Scale, 500 feet to 1 inch
740. Montague, Halifax county. Scale, 250 feet to 1 inch.
721. Waverley, Halifax county. Scale, 250 feet to 1 inch.
642. Oldham, Halifax county. Scale, 500 feet to 1 inch.
701. Renfrew, Hants county. Scale, 500 feet to 1 inch.
768. South Uniacke, Hants county. Scale, 250 feet to 1 inch.
709. Mount Uniacke, Hants county. Scale, 250 feet to 1 inch.
844. Gold River, Lunenburg county. Scale, 250 feet to 1 inch.
937. Leipsigate, Lunenburg county. Scale, 500 feet to 1 inch.
850. Transverse Section of Doliver Gold district.
849. Transverse Section of West Lake mine, Mount Uniacke.
866. Transverse Vertical Section of Blue-Nose Gold mine.
995. Plan and Section of Malaga Gold district, Queens county. Scale, 250 feet to 1 inch.
1012. Plan and Sections of Brookfield Gold district. Scale, 250 feet to 1 inch.

INDEX

C

D

E

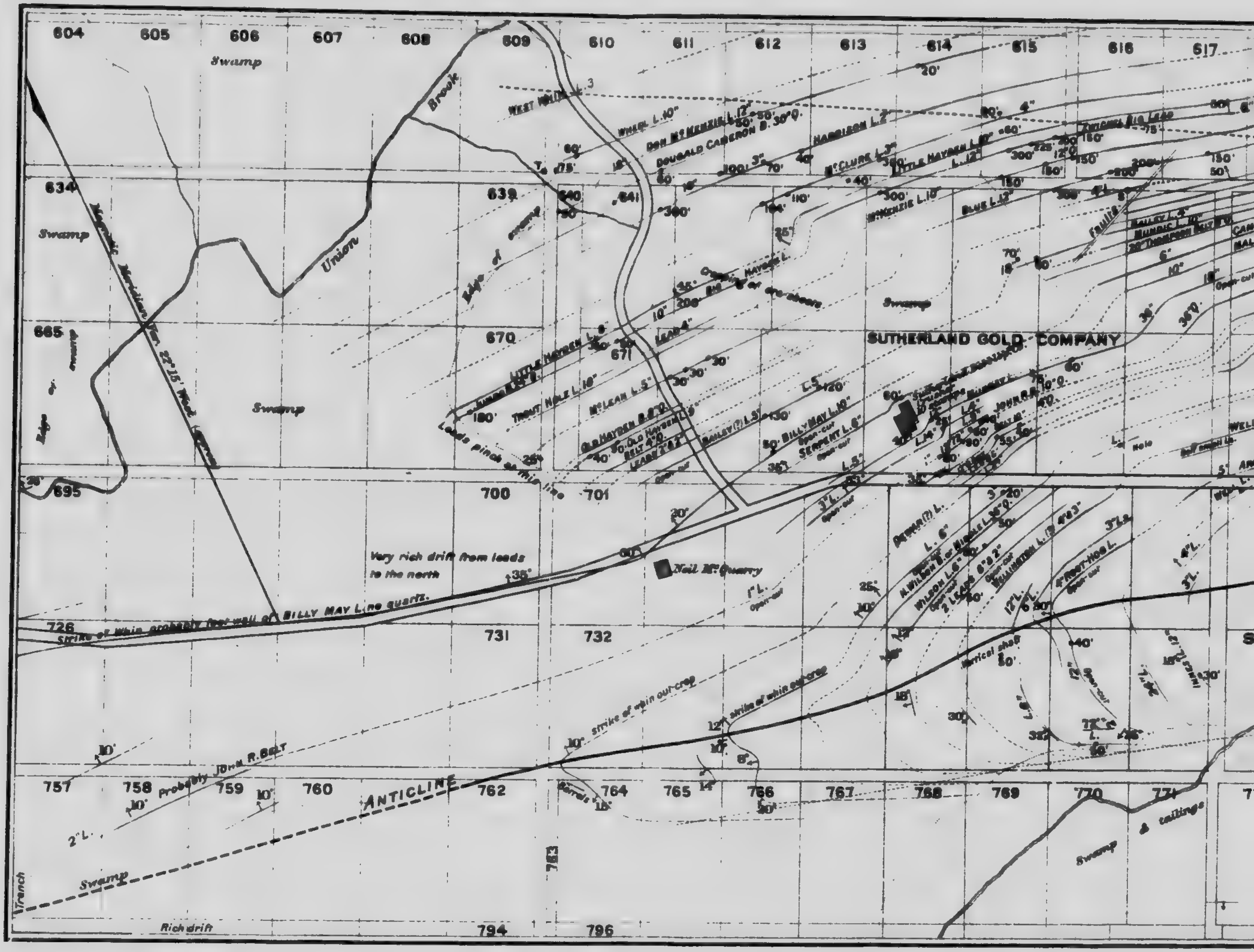
F

G

8
8
8
8

8
8
8

DEPARTMENT OF MINES—GEOLOGICAL SURVEY.



Geologically surveyed in 1897, by E. R. Faribault.

Horizontal and Vertical Scales 250 Feet to 1 Inch

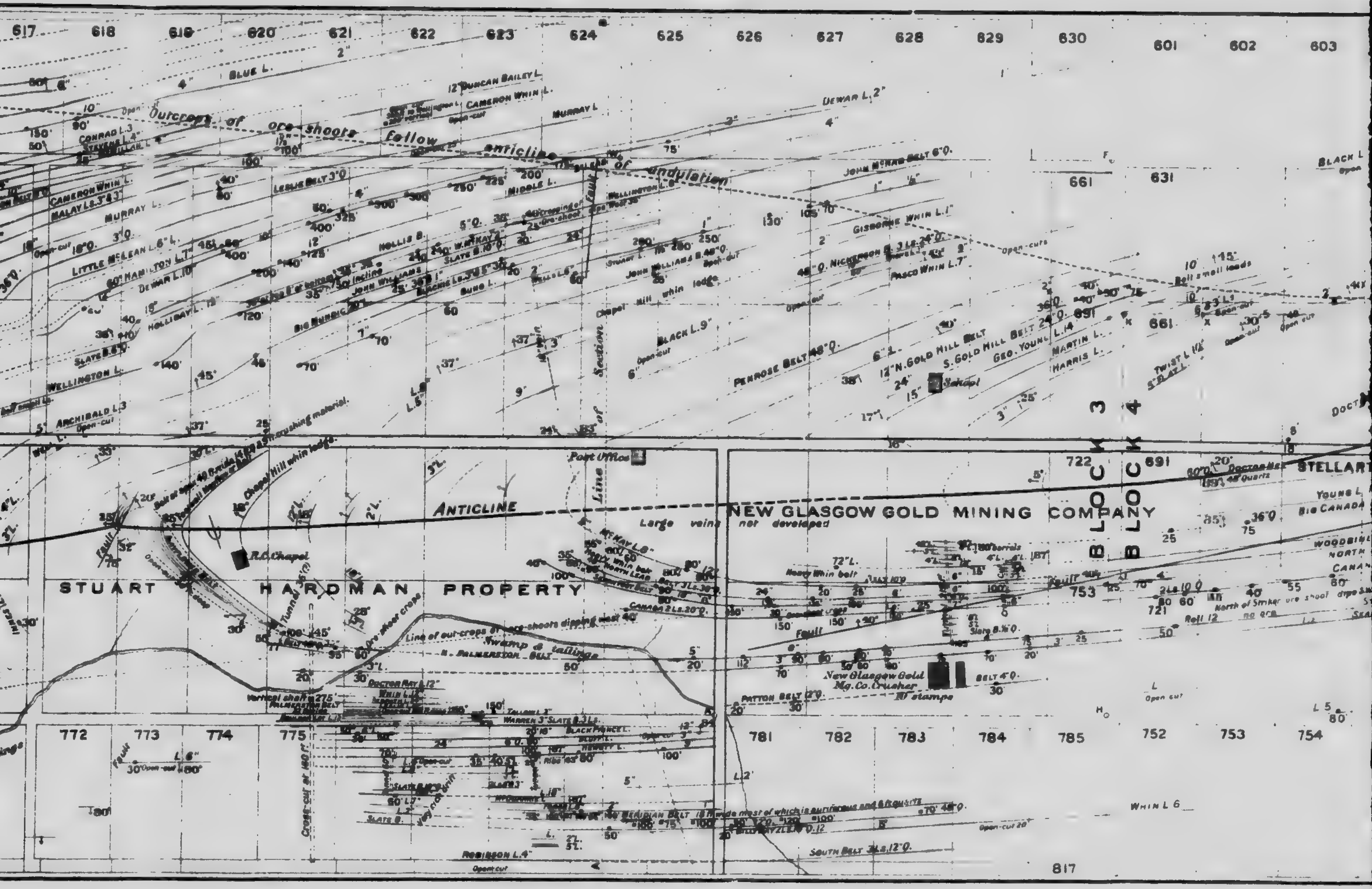


Fig. 22.—Plan and Section of Goldenville Gold District, Guysborough Co., N.

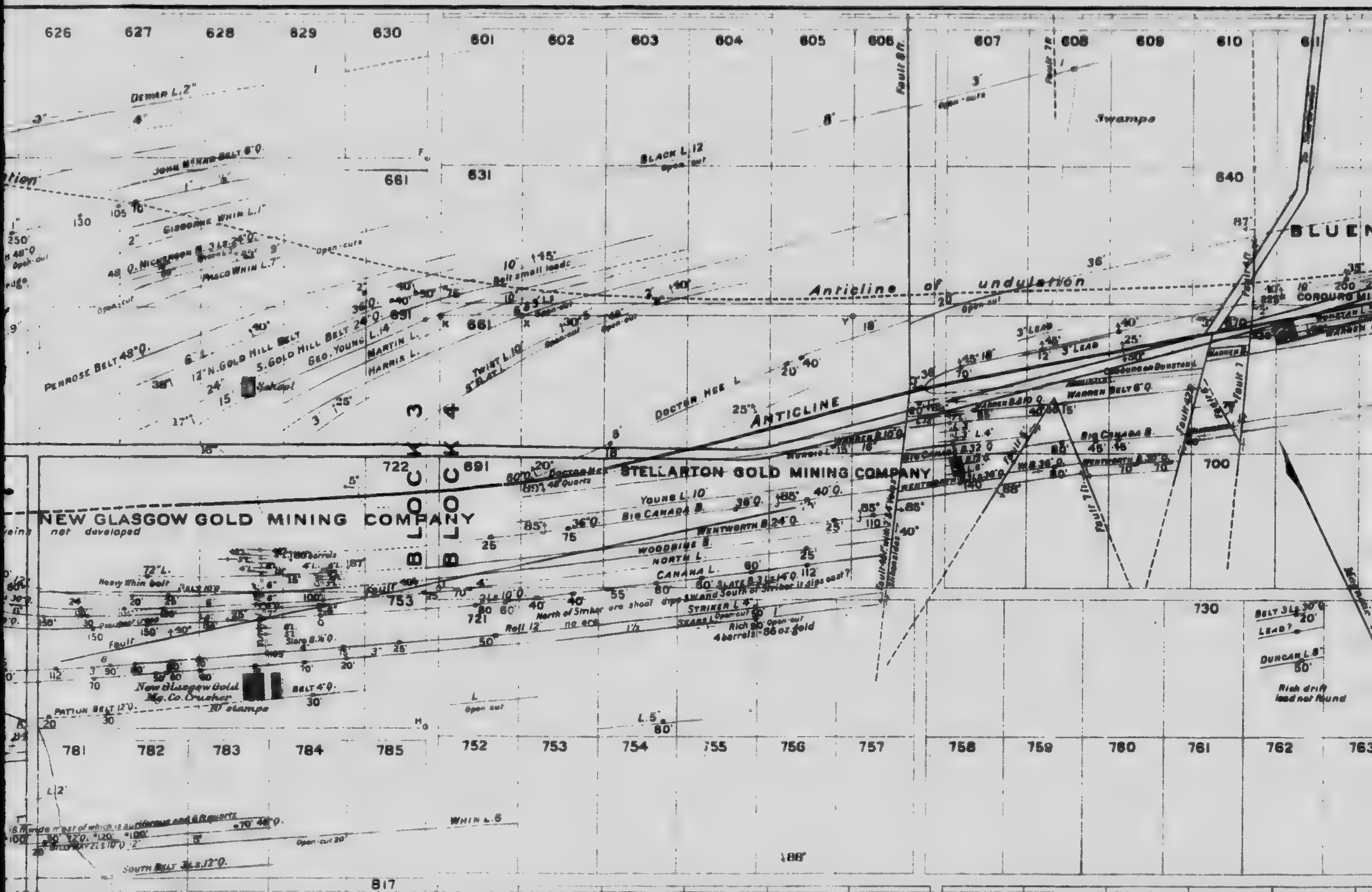
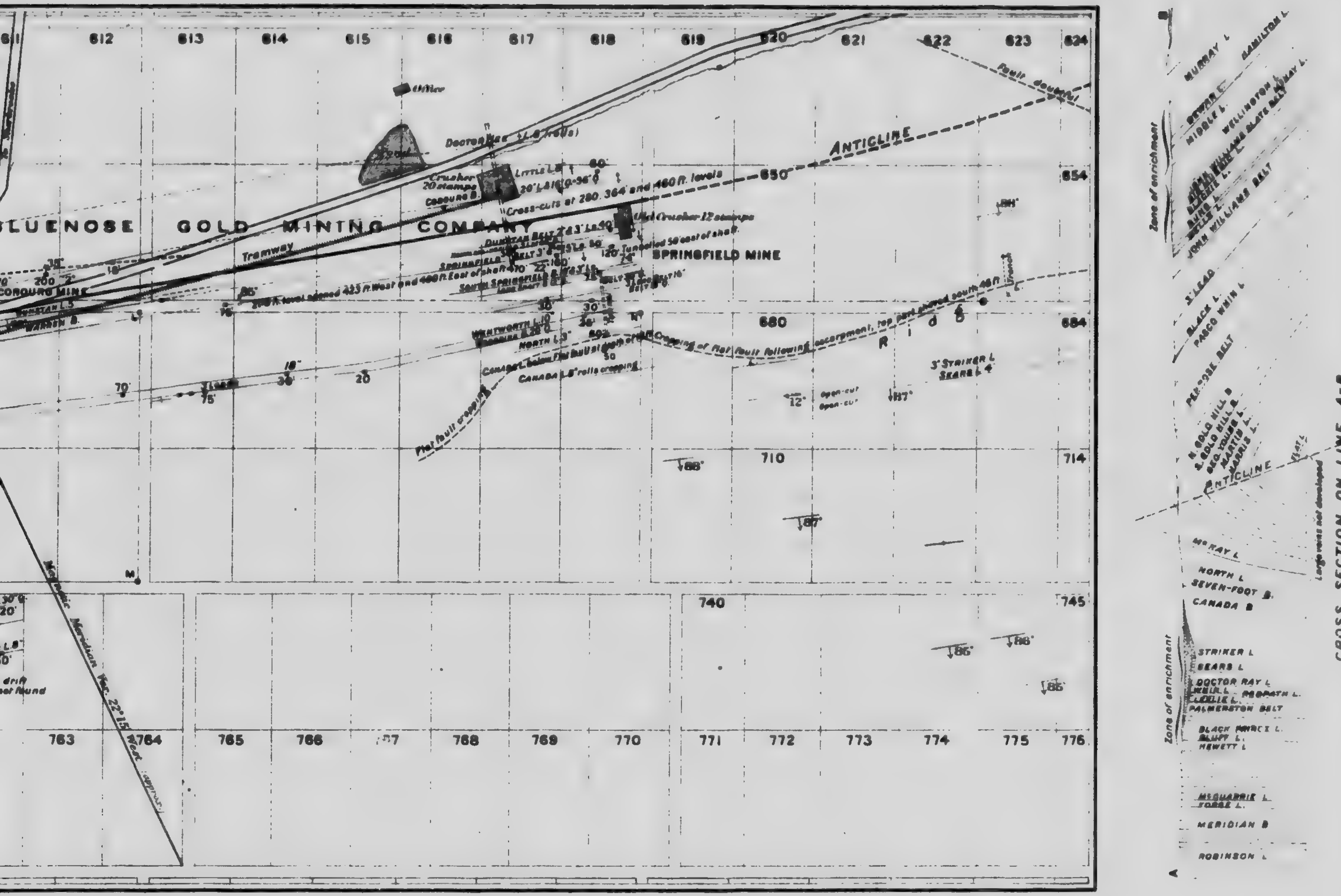
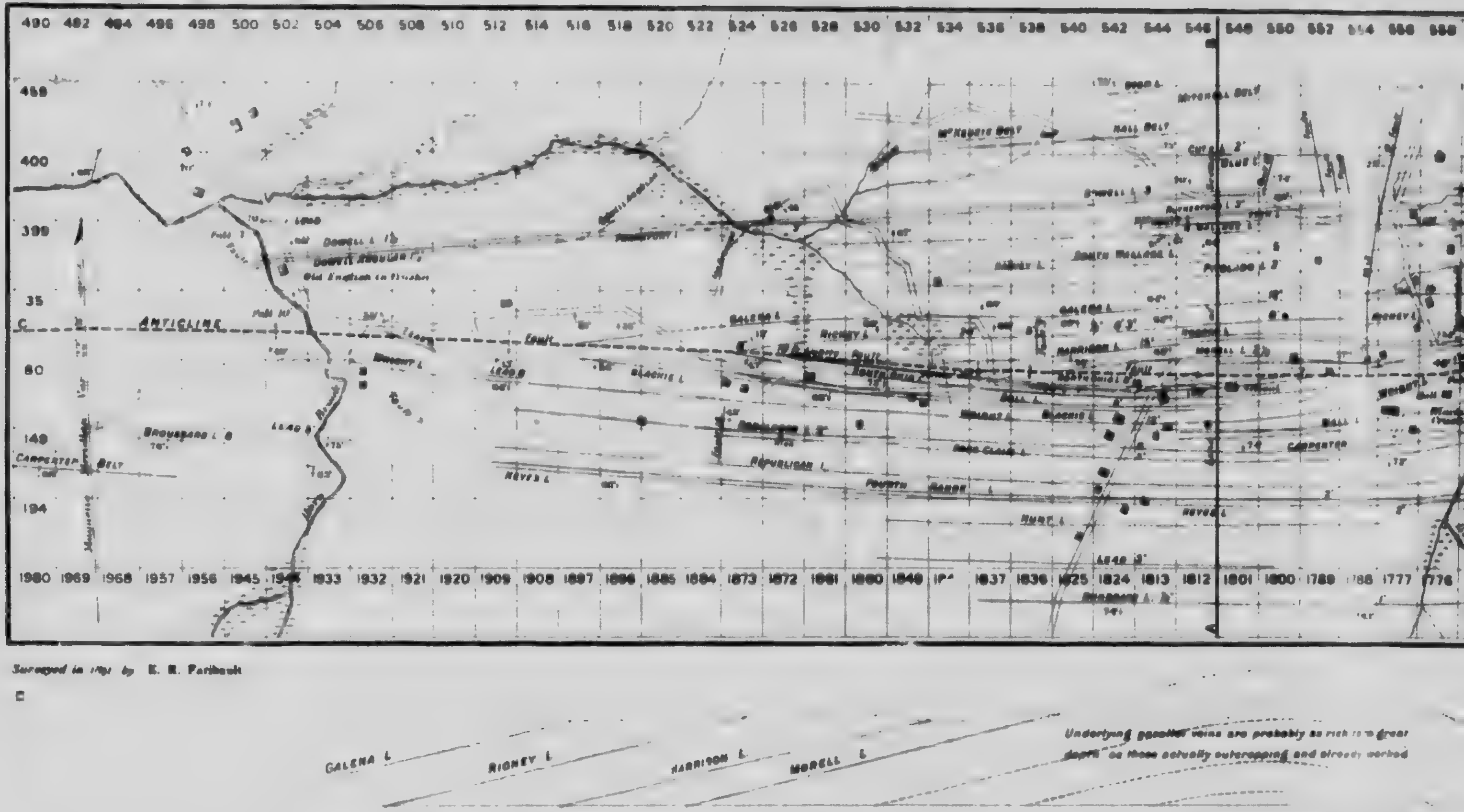


Fig. 22.—**Plan and Section of Goldenville Gold District, Guysborough Co., N.S.**



To accompany Memoir No. 20.

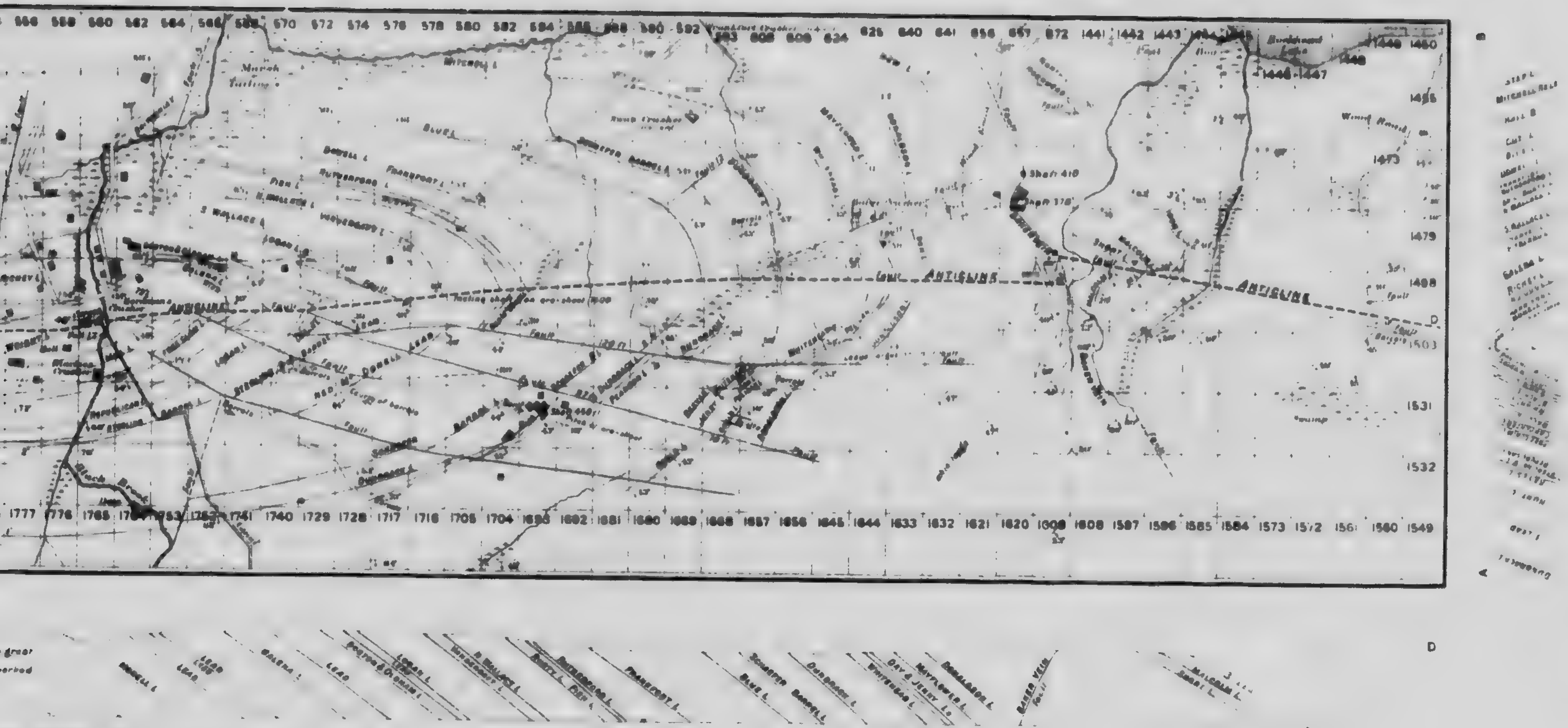
Department of Mines—Geological Survey



Surveyed in 1891 by E. R. Faribault

Horizontal and Vertical Scales 500 Feet to 1 Inch

Fig. 23, Plan and Sections of O

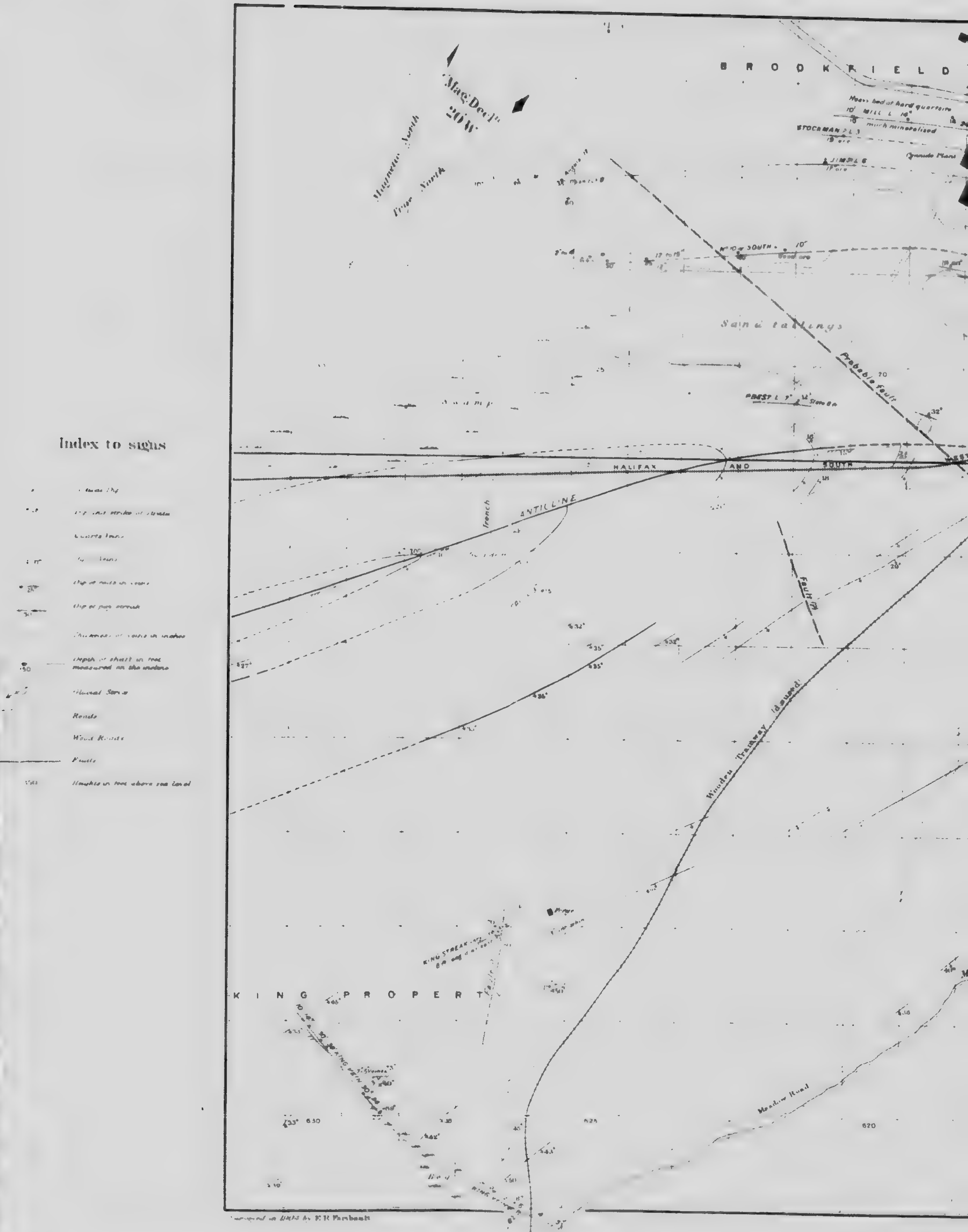


ON THROUGH APEX OF ANTICLINE (NORTH OF THE FAULT)

ctions of Oldham Gold District, Halifax Co., N.S.

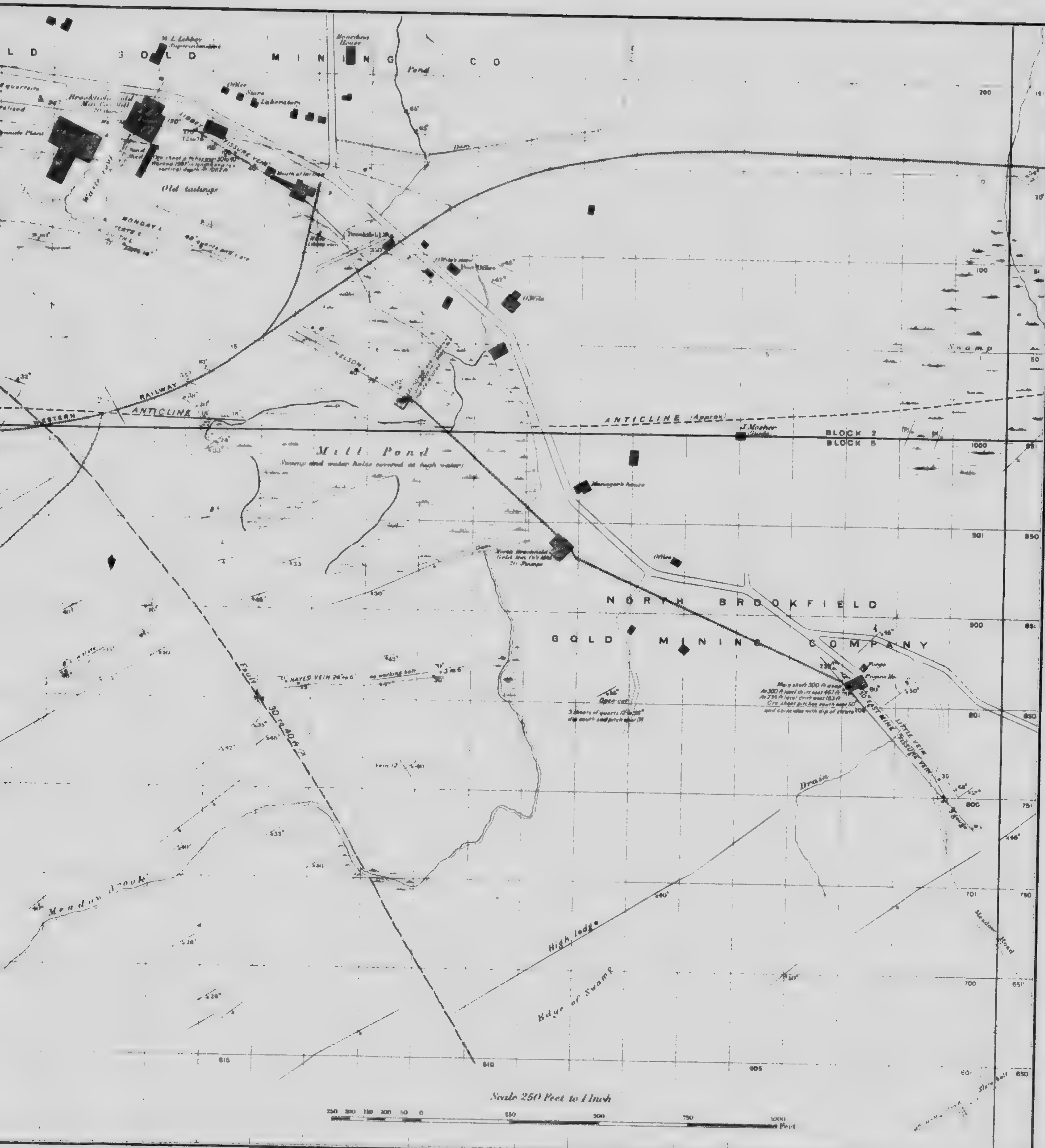
To accompany Memoir No. 20

983
387,
367,
'42.
in
e 1
h
2
07
h
m
100
f
p
ha-
h
4.
1
le
6.
2
h
1
8.
p



Index to signs
Roads
Faults
Heights in feet above sea level
B R O O K F I E L D
Magnetic North
True North
Heavy bed of hard quartzite
much mineralised
STOCKMAN
JIMBLE
Cyanide Plant
Good ore
Sand tailings
Probable fault
HALIFAX
AND
SOUTH
ANTICLINE
Trench
Fault
Wooden Tramway (disused)
K I N G P R O P E R T Y
Meadow Road

Fig.24. Plan o



Plan of Brookfield Gold District, Queens Co., N.S.

To accompany Memoir No. 20

S

Re
N

Mi
No

Min
N

Rep
N

CANADA

DEPARTMENT OF MINES

GEOLOGICAL SURVEY BRANCH

HON. ROBERT ROGERS, MINISTER; A. P. LOW, DEPUTY MINISTER;
R. W. BROCK, DIRECTOR.

SELECTED LIST OF REPORTS AND MAPS

(SINCE 1885)

OF SPECIAL ECONOMIC INTEREST

[illegible]

THE GEOLOGICAL SURVEY.

Report of the Mines Section:—

No. 245.	[illegible]ort of Mines Sect[illegible] 1886.	No. 66[illegible].	Report of Mines Sect[illegible] [illegible]
272	" " 1887	69[illegible]	" " 1898
*300	" " 188[illegible]	71[illegible]	" " [illegible]
301	" " 188[illegible]	7[illegible]	" " [illegible]
334	" " 1890	[illegible]	" " [illegible]
[illegible]	" " 189[illegible]	[illegible]	" " [illegible]
[illegible]	" " [illegible]	[illegible]	" " [illegible]
[illegible]	" " [illegible]	*[illegible]	" " [illegible]
602	" " [illegible]	[illegible]	" " [illegible]
[illegible]25	" " [illegible]		

Mineral Production of Canada:

No. *414.	Year 1886	No. *[illegible]	Year [illegible]	No. [illegible]	Year [illegible]
*415	" 1887	*[illegible]	" [illegible]	[illegible]	" 190[illegible]
*416	" 1888	*[illegible]	" [illegible]	[illegible]	" 190[illegible]
*417	" 1889	*[illegible]	" [illegible]	[illegible]	" 19[illegible]
*418	" 1890	*[illegible]	" [illegible]	[illegible]	" [illegible]
*419	" 18[illegible]	*[illegible]	" [illegible]	[illegible]	" [illegible]
*420	" 18[illegible]	*[illegible]	" [illegible]	[illegible]24	" [illegible]
*421	" 189[illegible]	*[illegible]	" [illegible]	[illegible]	" [illegible]

Mineral Resources Bulletin:

No. *[illegible]18.	Platinum.	No. [illegible]	[illegible]	[illegible]	[illegible]
851	Coal.	[illegible]	M[illegible]	[illegible]	[illegible]
*854	Asb[illegible]	[illegible]	M[illegible]	[illegible]	M[illegible]
857	Infus[illegible] Earth	*[illegible]	[illegible]	[illegible]	[illegible]
8[illegible]	Manganese	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]9	Salt.				

Report of the Section of Chemistry and Mineralogy:

No. *102	Year 1874-5	No. [illegible]	[illegible]	No. [illegible]	Year [illegible]
*110	" 1875-6	[illegible]	[illegible]	[illegible]	" [illegible]
*119	" 1876-7	[illegible]	[illegible]	[illegible]	" [illegible]
*126	" 1877-8	[illegible]	[illegible]	[illegible]	" [illegible]
*138	" 1878-9	[illegible]	[illegible]	[illegible]	" [illegible]
*148	" 1879-80	[illegible]	[illegible]	[illegible]	" [illegible]
*156	" 1880-1-2	[illegible]	[illegible]	*95[illegible]	" [illegible]

* [illegible]

REPORTS.

GENERAL.

745. Altitudes of Canada, by J. White. 1899.
*972. Descriptive Catalogue of Minerals and Rocks, by R. A. A. Johnston and G. A. Young.
1073. Catalogue of Publications: Reports and Maps (1843-1909).
1085. Descriptive Sketch of the Geology and Economic Minerals of Canada, by G. A. Young, and Introductory by R. W. Brock. Maps No. 1084, No. 1042 (second edition), scale 100 m. = 1 in.
1086. French translation of Descriptive Sketch of the Geology and Economic Minerals of Canada, by G. A. Young, and Introductory by R. W. Brock. Maps No. 1084; No. 1042 (second edition), scale 100 m. = 1 in.
1107. Part II. Geological position and character of the oil-shale deposits of Canada, by R. W. Ells.
1146. Notes on Canada, by R. W. Brock.

YUKON.

*260. Yukon district, by G. M. Dawson. 1887. Maps No. 274, scale 60 m. = 1 in.; Nos. 275 and 277, scale 8 m. = 1 in.
*295. Yukon and Mackenzie basins, by R. G. McConnell. 1889. Map No. 304, scale 48 m. = 1 in.
687. Klondike gold fields (preliminary), by R. G. McConnell. 1900. Map No. 688, scale 2 m. = 1 in.
884. Klondike gold fields, by R. G. McConnell. 1901. Map No. 772, scale 2 m. = 1 in.
*909. Windy Arm, Tagish lake, by R. G. McConnell. 1906. Map No. 916, scale 2 m. = 1 in.
943. Upper Stewart river, by J. Keele. Map No. 938, scale 8 m. = 1 in. } Bound together
951. Peel and Wind rivers, by Chas. Camsell. Map No. 942, scale 8 m. = 1 in. } Bound together
979. Klondike gravels, by R. G. McConnell. Map No. 1011, scale 40 ch. = 1 in.
982. Conrad and Whitehorse mining districts, by D. D. Cairnes. 1907. Map No. 990, scale 2 m. = 1 in.
1016. Klondike Creek and Hill gravels, by R. G. McConnell. (French.) Map No. 1011, scale 40 ch. = 1 in.
1050. Whitehorse Copper Belt, by R. G. McConnell. Maps Nos. 1,026, 1,041, 1,044-1,049.
1097. Reconnaissance across the Mackenzie mountains on the Pelly, Ross, and Gravel rivers, Yukon, and North West Territories, by Joseph Keele. Map No. 1099, scale 8 m. = 1 in.
1011. Memoir No. 5 (Preliminary): on the Lewes and Nordenskiöld Rivers coal-field, Yukon, by D. D. Cairnes. Maps Nos. 1103 and 1104, scale 2 m. = 1 in.

BRITISH COLUMBIA.

212. The Rocky mountains (between latitudes 49° and 51° 30'), by G. M. Dawson. 1885. Map No. 223, scale 6 m. = 1 in. Map No. 224, scale 1½ m. = 1 in.
*235. Vancouver island, by G. M. Dawson. 1886. Map No. 247, scale 8 m. = 1 in.
236. The Rocky mountains, geological structure, by R. G. McConnell. 1886. Map No. 248, scale 2 m. = 1 in.
263. Cariboo mining district, by A. Bowman. 1887. Maps Nos. 278-281.
*271. Mineral wealth, by G. M. Dawson.

* Publications marked thus are out of print.

*294. West Kootenay district, by G. M. Dawson. 1888-9. Map No. 303, scale 8 m. = 1 in.

*573. Kamloops district, by G. M. Dawson. 1894. Maps Nos. 556 and 557, scale 4 m. = 1 in.

574. Finlay and Omineca rivers, by R. G. McConnell. 1894. Map No. [illegible], scale 8 m. = 1 in.

743. Atlin Lake mining division, by J. C. Gwillim. 1899. Map No. 742, scale 4 m. = 1 in.

939. Rossland district, by R. W. Brock. Map No. 941, scale 1,600 ft. = 1 in.

940. Graham island, by R. W. Ells. 1905. Maps No. 921, scale 4 m. = 1 in.; No. 922, scale 1 m. = 1 in. [illegible]

986. Similkameen district, by Chas. Camsell. Map No. 987, scale 400 ch. = 1 in.

988. Telkwa river and vicinity, by W. W. Leach. Map No. 989, scale 2 m. = 1 in.

996. Nanaimo and New Westminster districts, by O. E. LeRoy. 1907. Map No. 997, scale 4 m. = 1 in.

1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling.

1093. Geology, and Ore Deposits of Hedley Mining district, British Columbia, by Charles Camsell. Maps Nos. 1095 and 1096, scale 1,000 ft. = 1 in.; No. 1105, scale 600 ft. = 1 in.; No. 1106, scale 800 ft. = 1 in.; No. 112[illegible], scale 1,000 ft. = 1 in.

1121. Memoir No. 13. Southern Vancouver island, by Charles H. Clapp. Map No. 1123—17 A, scale 4 m. = 1 in.

1175. Memoir No. 21. Geology and [illegible] of Phoenix, Boundary district, by O. E. LeRoy. Maps Nos. [illegible]5 and 11[illegible]6, scale 400 ft. = 1 in.

1204. Memoir No. 24 E. Preliminary Report on the Clay and Shale Deposits of the Western Provinces, by Heinrich Ries and Joseph Keele. Map No. 1201 51 A, scale 3[illegible] = 1 in.

ALBERTA

*237. Central portion, by J. B. Tyrrell. 1886. Maps Nos. 24[illegible] and 250, scale 8 m. = 1 in.

*324. Peace and Athabaska Rivers district, by R. G. McConnell. 1890-1. Map No. 336, scale 48 m. = 1 in.

703. Yellowhead Pass route, by J. McEvoy. 1898. Map No. 676, scale 8 m. = 1 in.

*949. Cascade coal fields, by D. B. Dowling. Maps (8 sheets) Nos. 929-936, scale 1 m. = 1 in.

968. Moose Mountain district, by D. D. Cairnes. Maps No. 963, scale 2 m. = 1 in.; No. 966, scale 1 m. = 1 in.

1035. Coal fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m. = 1 in.

1035a. French translation of coal fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m. = 1 in.

11[illegible]. Memoir No. 8 E. Edmonton coal field, by D. B. Dowling. Maps Nos. 1117 5 A and 1118 6 A, scale 2640 ft. = 1 in.

1130. Memoir No. 9 E. Bighorn coal basin, Alta., by G. S. Malloch. Map No. 1132, scale 2 m. = 1 in.

1204. Memoir No. 24 E. Preliminary Report on the Clay and Shale Deposits of the Western Provinces, by Heinrich Ries and Joseph Keele. Map No. 1201 5 A, scale 3[illegible] m. = 1 in.

SASKATCHEWAN

213. Cypress hills and Wood mountain, by R. G. McConnell. 1885. Maps Nos. 225 and 226, scale 8 m. = 1 in.

[illegible]01. Country between Athabaska lake and Churchill river, by J. B. Tyrrell and D. B. Dowling. 1895. Map No. 957, scale 2[illegible] m. = 1 in.

* Publications marked thus are out of print.

868 Souris River coal-field, by D. B. Dowling. 1902

1035. Coal-fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m. = 1 in.

1204. Memoir No. 24 E. Preliminary Report on the Clay and Shale Deposits of the Western Provinces, by Heinrich Ries and Joseph Keele. Map No. 1201 51 A, scale 35 m. = 1 in.

MANITOBA

264. Duck and Riding mountains, by J. B. Tyrrell. 1887-8. Map No. 282, scale 8 m. = 1 in.

296 Glacial Lake Agassiz, by W. Upham. 1889. Maps Nos. 314, 315, 316

325 Northwestern portion, by J. B. Tyrrell. 1890-1. Maps Nos. 339 and 350, scale 8 m. = 1 in.

704 Lake Winnipeg (west shore), by D. B. Dowling. 1898. Map No. 664, scale 8 m. = 1 in.
705 Lake Winnipeg (east shore), by J. B. Tyrrell. 1898. Map No. 664, scale 8 m. = 1 in.
} Bound together

1035. Coal fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling. Map No. 1010, scale 35 m. = 1 in.

1204 Memoir No. 24 E. Preliminary Report on the Clay and Shale Deposits of the Western Provinces, by Heinrich Ries and Joseph Keele. Map No. 1201 51 A, scale 35 m. = 1 in.

NORTH WEST TERRITORIES

217. Hudson bay and strait, by R. Bell. 1885. Map No. 229, scale 4 m. = 1 in.

238 Hudson bay, south of, by A. P. Low. 1886.

239 Attawapiskat and Albany rivers, by R. Bell. 1886

244 Northern portion of the Dominion, by G. M. Dawson. 1886. Map No. 255, scale 200 m. = 1 in.

267 James bay and country east of Hudson bay, by A. P. Low.

578 Pen lake and part of Berens river, by D. B. Dowling. 1894. Map No. 576, scale 8 m. = 1 in.

*584 Labrador peninsula, by A. P. Low. 1895. Maps Nos. 585-588, scale 25 m. = 1 in.

618 Dubawnt, Kazan, and Ferguson rivers, by J. B. Tyrrell. 1896. Map No. 603, scale 25 m. = 1 in.

657 North[illegible] portion of the Labrador peninsula, by A. P. Low.

680 South Shore Hudson strait and Ungava bay, by A. P. Low. Map No. 699, scale 25 m. = 1 in.
713 North Shore Hudson strait and Ungava bay, by R. Bell. Map No. 699, scale 25 m. = 1 in.
} Bound together

725. Great Bear lake to Great Slave lake, by J. M. Bell. 1900.

778. East coast Hudson bay, by A. P. Low. 1900. Maps Nos. 779, 780, 781, scale 8 m. = 1 in.

786 787. Grass River region, by J. B. Tyrrell and D. B. Dowling. 1900

815. Ekwan river and Sutton lakes, by D. B. Dowling. 1901. Map No. 751, scale 50 m. = 1 in.

819. Nastapoka islands, Hudson bay, by A. P. Low. 1900

905 The Cruise of the *Neptune*, by A. P. Low. 1905

100[illegible]. Report of a Traverse through the Southern Part of the North West Territories, from Lac Seul to Cat lake, 1902, by A. W. G. Wilson.
1080 Report on a Part of the North West Territories, drained by the Winisk and Upper Attawapiskat rivers, by W. McInnes. Map No. 1089, scale 8 m. = 1 in.
} Bound together

10[illegible] French translation. Report on an exploration of the East coast of Hudson bay, from Cape Wolstenholme to the south end of James bay, by A. P. Low. Maps Nos. 779, 780, 781, scale 8 m. = 1 in., No. 785, scale 50 m. = 1 in.

* Publications marked thus are out of print.

1097. **Reconnaissance** [illegible] Mackenzie [illegible] and Gravel river [illegible] Yukon and North West [illegible] by Joseph Keele. Map No. 1099, scale 8 m. = 1 in.

ONTARIO

215. **Lake of the Woods** region, by A. C. Lawson [illegible] Map No. [illegible] scale 2 m. = 1 in.

*265 **Rainy Lake** region, by A. C. Lawson. 1887. Map No. 227 [illegible] m. = 1 in.

266 **Lake Superior,** mines and mining, by E. D. Ingall. 1888. Maps No. 285, scale 4 m. = 1 in. [illegible] No. 286, scale 20 ch. = 1 in.

326 **Sudbury mining district,** by R. Bell. 1890-1. Map No. 303, scale 4 m. = 1 in.

327. **Hunter island,** by W. H. C. Smith. 1890-1. Map No. 312, scale 4 m. = 1 in.

332. **Natural Gas** and Petroleum, by H. P. H. Brumell. 1890-1. Maps Nos. 344 [illegible]

357 Victoria, Peterborough and Hastings counties, by F. D. Adams. 1892-3

627. On the French River sheet, by R. Bell. [illegible] Map No. 570, scale 4 m. = 1 in.

678 [illegible] river and [illegible] 1897. Maps No. [illegible] M. Ingall [illegible]

723 Iron deposits along the [illegible] by E. D. Ingall. 1900. Map No. [illegible] 12 miles [illegible]

*739. Carleton, Russell [illegible] No. 739, Quebec [illegible] R. W. Ells. 1899 [illegible]

741. Ottawa and vicinity, by R. W. Ells. 1900.

790 Perth sheet, by R. W. Ells [illegible]

961 Sudbury Nickel and Copper [illegible] A. E. Barlow [illegible] Maps No. 775 [illegible] 400 ft. = 1 in.

962 Nipissing and Temiskaming [illegible] by A. E. Barlow [illegible] Maps No. [illegible] 4 m. = 1 in.

965 Sudbury Nickel and Copper [illegible] A. E. Barlow [illegible] No. 944, scale [illegible]

970 Report on Niagara Falls [illegible] by J. W. Spencer. Map No. 926 [illegible]

977 Report on Pembroke sheet, by R. W. Ells. Map No. [illegible] scale 4 m. = 1 in.

980 Geological reconnaissance [illegible] and Thunder Bay [illegible] by W. J. Wilson. Map No. [illegible]

981. On the region [illegible] between the [illegible] W. H. Collins. Map No. [illegible] 1 in.

992. Report on Northwestern [illegible] tinental railway [illegible] Transcontinental W. H. Collins [illegible] lake, by [illegible]

996. Report on Pembroke [illegible] scale 4 m. = 1 in. [illegible] Map No. 966.

999. French translation [illegible] by W. H. Collins. Map No. 1076, scale [illegible]

1038. French translation [illegible] between Lake Nipigon [illegible] Map No. 963, scale [illegible] W. H. Collins

1059. Geological reconnaissance [illegible] Transcontinental [illegible] lake, Ont., by W. H. Collins [illegible]

1075. Gowganda Mining Division [illegible] Map No. 1076, scale 1 m. = 1 in.

* Publications marked [illegible]
2869 [illegible]

1062 Memoir No. 6: Geology of the Haliburton and Bancroft areas, Ont by Frank D. Adams and Alfred E. Barlow. Maps No. 708, scale 4 m. = 1 in.; No. 770, scale 2 m. = 1 in.

1091 Memoir No. 1: On the Geology of the Nipigon basin, Ont., by A. W. G. Wilson. Map No. 1090, scale 4 m. = 1 in.

1114. French translation: Geological reconnaissance of a portion of Algoma and Thunder Bay district, Ont., by W. J. Wilson. Map No. 964, scale 8 m. = 1 in.

1119. French translation: On the region lying north of Lake Superior, between the Pic and Nipigon rivers, Ont., by W. H. Collins. Map No. 964, scale 8 m. = 1 in.

Bound together.

QUEBEC.

216 Mistassini expedition, by A. P. Low. 1884-5. Map No. 228, scale 8 m. = 1 in.

240 Compton, Stanstead, Beauce, Richmond, and Wolfe counties, by R. W. Ells. 1886. Map No. 251 (Sherbrooke sheet), scale 4 m. = 1 in.

268. Megantic, Beauce, Dorchester, Lévis, Bellechasse, and Montmagny counties, by R. W. Ells. 1887-8. Map No. 287, scale 40 ch. = 1 in.

297. Mineral resources, by R. W. Ells. 1889.

328. Portneuf, Quebec, and Montmagny counties, by A. P. Low. 1890-1.

579. Eastern Townships, Montreal sheet, by R. W. Ells and F. D. Adams, 1894. Map No. 571, scale 4 m. = 1 in.

591 Laurentian area north of the Island of Montreal, by F. D. Adams. 1895. Map No. 590, scale 4 m. = 1 in.

670. Auriferous deposits, southeastern portion, by R. Chalmers. 1895. Map No. 667, scale 8 m. = 1 in.

707. Eastern Townships, Three Rivers sheet, by R. W. Ells. 1898.

*739 Argenteuil, Ottawa, and Pontiac counties, by R. W. Ells. 1899 (See No. 739, Ontario).

788. Nottaway basin, by R. Bell. 1900. *Map No. 702, scale 10 m. = 1 in.

863 Wells on Island of Montreal, by F. D. Adams. 1901. Maps Nos. 874, 875, 876.

923 Chibougamau region, by A. P. Low. 1905.

962 Timiskaming map-sheet, by A. E. Barlow. (Reprint). Maps Nos. 599, 606, scale 4 m. = 1 in.; No. 944, scale 1 m. = 1 in.

974 Report on Copper-bearing rocks of Eastern Townships, by J. A. Dresser. Map No. 976, scale 8 m. = 1 in.

975 Report on Copper-bearing rocks of Eastern Townships, by J. A. Dresser. (French)

998 Report on the Pembroke sheet, by R. W. Ells. (French).

1028 Report on a Recent Discovery of Gold near Lake Megantic, Que., by J. A. Dresser. Map No. 1029, scale 2 m. = 1 in.

1032 Report on a Recent Discovery of Gold near Lake Megantic, Que., by J. A. Dresser. (French). Map No. 1029, scale 2 m. = 1 in.

1052 French translation report on Artesian wells in the Island of Montreal, by Frank D. Adams and O. E. LeRoy. Maps No. 874, scale 4 m. = 1 in.; No. 875, scale 3,000 ft. = 1 in.; No. 876.

1064. Geology of an Area adjoining the East Side of Lake Timiskaming, Que., by Morley E. Wilson. Map No. 1066, scale 1 m. = 1 in.

1110. Memoir No. 4: Geological Reconnaissance along the line of the National Transcontinental railway in Western Quebec, by W. J. Wilson. Map No. 1112, scale 4 m. = 1 in.

1144 Reprint of Summary Report on the Serpentine Belt of Southern Quebec, by J. A. Dresser.

NEW BRUNSWICK.

218. Western New Brunswick and Eastern Nova Scotia, by R. W. Ells. 1885. Map No. 230, scale 4 m. = 1 in.

---

* Publications marked thus are out of print.

219. **Carleton and Victoria** [illegible] by L. W. [illegible] No. 231, scale 4 m. [illegible]
242. Victoria, Restigouche, and [illegible] N.B., by L. W. Bailey and W. [illegible] scale [illegible]
269. Northern port[illegible] L. W. Bailey and W. McInnes, 1887. [illegible]
336. Temiscouata and [illegible] L. W. Bailey and W. McInnes, [illegible]
661. Mineral resources, [illegible] W. Bailey, 1897. Map No. 675, scale 10 m. = 1 in. New [illegible] by R. W. [illegible] 1887.
[illegible] Carboniferous [illegible] W. [illegible]
[illegible] Coal prospects [illegible] together.
983. Mineral resources, [illegible] Map No. [illegible] scale 16 m. = 1 in.
1034. Mineral resources [illegible] Map No. 989, scale 16 m. = 1 in.
1113. Memoir No. 16 E. [illegible] Nova Scotia and portions of New B[illegible] J. Keele. Map No. 1153, scale 12 [illegible]

NOVA SCOTIA

243. Guysborough, [illegible] ter, and Halifax counties by Hugh Fletcher [illegible]
[illegible] Pictou and Colchester [illegible]
[illegible] Southwestern Nova Scotia [illegible] L. W. Bailey, 1892. Map No. 362, [illegible]
628. Southwestern Nova [illegible] Map No. 641, scale [illegible]
[illegible] Sydney coal-field [illegible] Maps Nos. 652, 653, 654, scale 1 m. = 1 in.
797. Cambrian rocks of [illegible] by G. F. Matthew, 1900.
871. Pictou coal-field [illegible] 1902. Map No. 833, scale 25 ch. [illegible]
1113. Memoir No. 16 E. [illegible] Nova Scotia and portions of New B[illegible] H. Ries and J. Keele. Map No. 1153, scale 12 [illegible]

[illegible]

1042. Dominion of Canada [illegible]

YUKON

*805. Explorations [illegible] Upper [illegible] wart rivers, scale [illegible]
891. [illegible] 1 in.
[illegible] Sketch Map [illegible]
*916. W[illegible] scale 2 m. = 1 in.
990. Conrad [illegible]
[illegible]
[illegible] Boundary [illegible] 40 chains [illegible]
[illegible] Lower [illegible]
[illegible] White [illegible]
[illegible] 1044 [illegible]
[illegible] Northwest Territories [illegible]
[illegible]
[illegible]

* [illegible]

BRITISH COLUMBIA

278. Cariboo Mining district, scale 2 m. = 1 in.
604 Shuswap Geological sheet, scale 4 m. = 1 in.
*771 Preliminary Edition, East Kootenay, scale 4 m. = 1 in.
767 Geological Map of Crowsnest [illegible] coal-fields, scale 4 m. = 1 in.
*791 West Kootenay Mineral [illegible], scale 2 m. = 1 in.
*792 West Kootenay G[illegible] 4 m. = 1 in.
828 Boundary Creek M[illegible] 4 m. = 1 in.
846 Nicola coal basin [illegible] 1 in.
941 Preliminary Geological Map of Rossland and vicinity, scale 1 [illegible] ft. = 1 in.
987 Princeton coal basin and Copper Mountain Mining camp, scale [illegible] ch. = 1 in.
989 Telkwa river and [illegible]
997 Nanaimo and New W[illegible] 1 in.
1001 Special Map of [illegible] Mining division, scale 4 m. = 1 in.
1002 Special Map of Rossland [illegible] sheet. Scale 400 ft. = 1 in.
1003 Rossland Mining camp [illegible] Scale 400 ft. = 1 in.
1004 Rossland Mining camp [illegible] sheet. Scale 1,200 ft. = 1 in.
1066 Sheep Creek Mining camp [illegible] sheet. Scale 1,200 ft. = 1 in.
1074 Sheep Creek Mining camp [illegible] sheet. Scale 1 m. = 1 in.
1095 1A Hedley Mining district. Topographical sheet. Scale 1 m. = 1 in.
1096 2A Hedley Mining district. Geological sheet. Scale 1,000 ft. = 1 in.
1105 4A Golden Zone Mining camp. Scale 600 ft. = 1 in.
1106 3A Mineral Claims on Henry creek. Scale 800 ft. = 1 in.
1123 17A Reconnaissance geological map of southern Vancouver island. Scale 4 m. = 1 in.
1125. Hedley Mining district. Structure Sections. Scale 1,000 ft. = 1 in.
Deadwood Mining camp. Scale 400 ft. = 1 in. (Advance sheet.)
1135 15A Phoenix, Boundary district. Topographical sheet. Scale 400 ft. = 1 in.
1136 16A Phoenix, Boundary district. Geological sheet. Scale 400 ft. = 1 in.
1164 28A Portland Canal Mining district, scale 2 m. = 1 in.
Beaverdell sheet, [illegible], scale 1 m. = 1 in. (Advance sheet.)
Tulameen sheet, scale 1 m. = 1 in. (Advance sheet.)

ALBERTA

594 596 Peace and Athabaska rivers, scale 10 m. = 1 in.
*808 Blairmore-Frank coal-fields, scale 180 ch. = 1 in.
892. Costigan coal basin, scale 40 ch. = 1 in.
929 936 Cascade coal basin. Scale 1 m. = 1 in.
963 1046 Moose Mountain region. Coal Areas. Scale 2 m. = 1 in.
1010 Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.
1117. 5A Edmonton. (Topography.) Scale ½ m. = 1 in.
1118. 6A Edmonton. (Clover Bar Coal Seam). Scale ½ m. = 1 in.
Portion of Jasper Park, scale 1 [illegible] = 1 in. (Advance sheet.)
1132. 7A Bighorn coal-field. Scale 2 m. = 1 in.
1201 51A Geological map of portions of Alberta, Saskatchewan, and Manitoba. Scale, 35 m. = 1 in.

SASKATCHEWAN

1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.
1201 51A Geological map of portions of Alberta, Saskatchewan, and Manitoba. Scale, 35 m. = 1 in.

MANITOBA

804 Part of Turtle mountain showing coal areas. Scale 1½ m. = 1 in.
1010. Alberta, Saskatchewan, and Manitoba. Coal Areas. Scale 35 m. = 1 in.

* Publications marked thus are out of print.

[illegible]

NEW BRUNSWICK

*678 Map of Principal Mineral Occurrences. Scale 10 m. = 1 in.
*799 Map of Principal Mineral Localities. Scale 16 m. = 1 in.
1155 20A. Millstream Iron deposits, N.B., scale 400 ft. = 1 in.
1156 25A. Nipisiguit Iron deposits, N.B., scale 400 ft. = 1 in.

NOVA SCOTIA

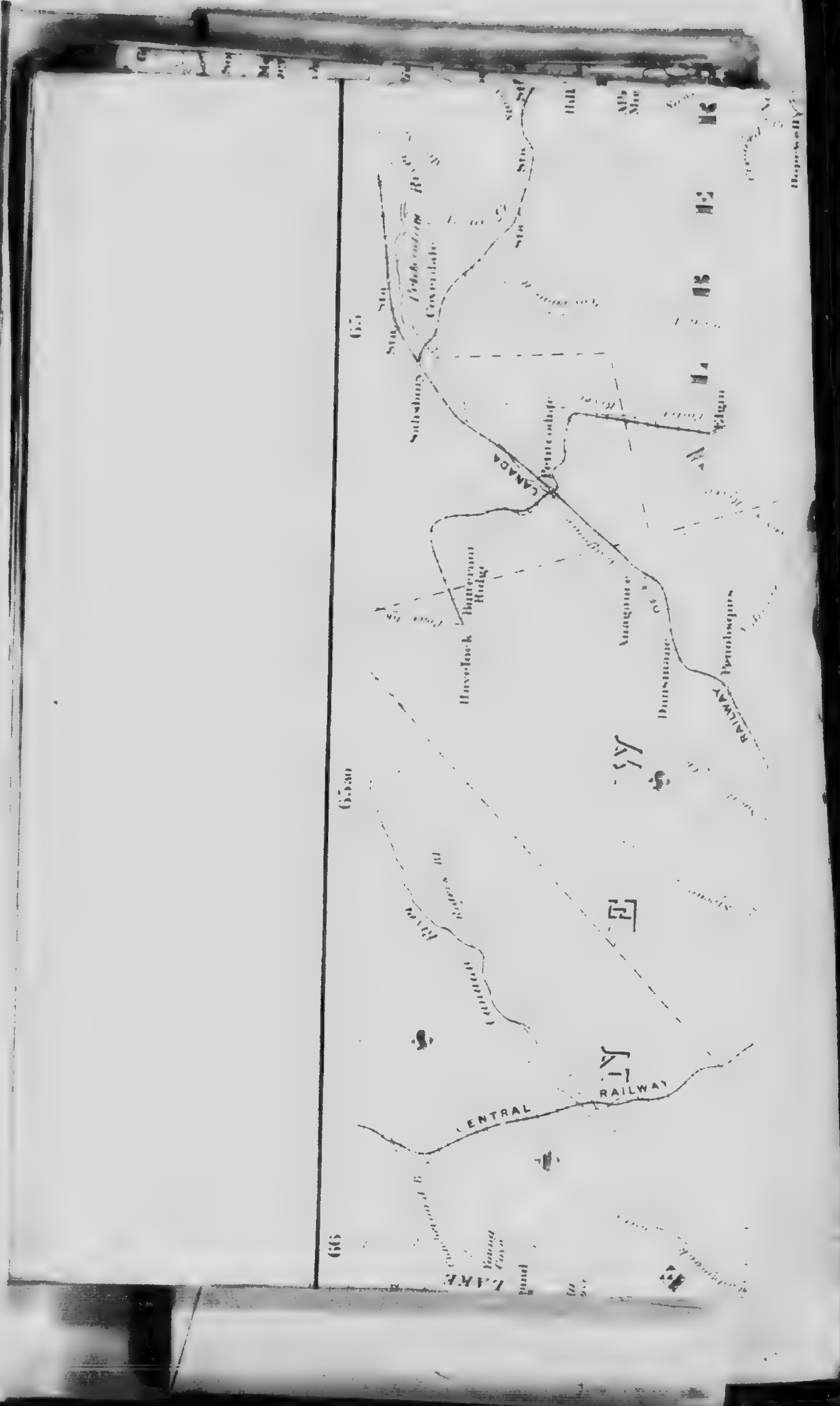
*812 Preliminary Map of Springhill coal field, scale 50 ch. = 1 in.
833 Pictou coal field, scale 25 ch. = 1 in.
*897 Preliminary Geological Plan of Nictaux and Torbrook iron district, scale 25 ch. = 1 in.
927 General Map of Province showing gold districts, scale 12 m. = 1 in.
937 Leipsigate Gold district, scale 500 ft. = 1 in.
945 Harrigan Gold district, scale 400 ft. = 1 in.
955 Malaga Gold district, scale 250 ft. = 1 in.
1012 Brookfield Gold district, scale 250 ft. = 1 in.
1019 Halifax Geological sheet. No. 68. Scale 1 m. = 1 in.
1025 Waverley Geological sheet. No. 67. Scale 1 m. = 1 in.
1036 St. Margaret Bay Geological sheet. No. 71. Scale 1 m. = 1 in.
1037 Windsor Geological sheet. No. 73. Scale 1 m. = 1 in.
1045 Aspotogan Geological sheet. No. 70. Scale 1 m. = 1 in.
1153 22A. Nova Scotia, scale 12 m. = 1 in.

* Publications marked thus are out of print.

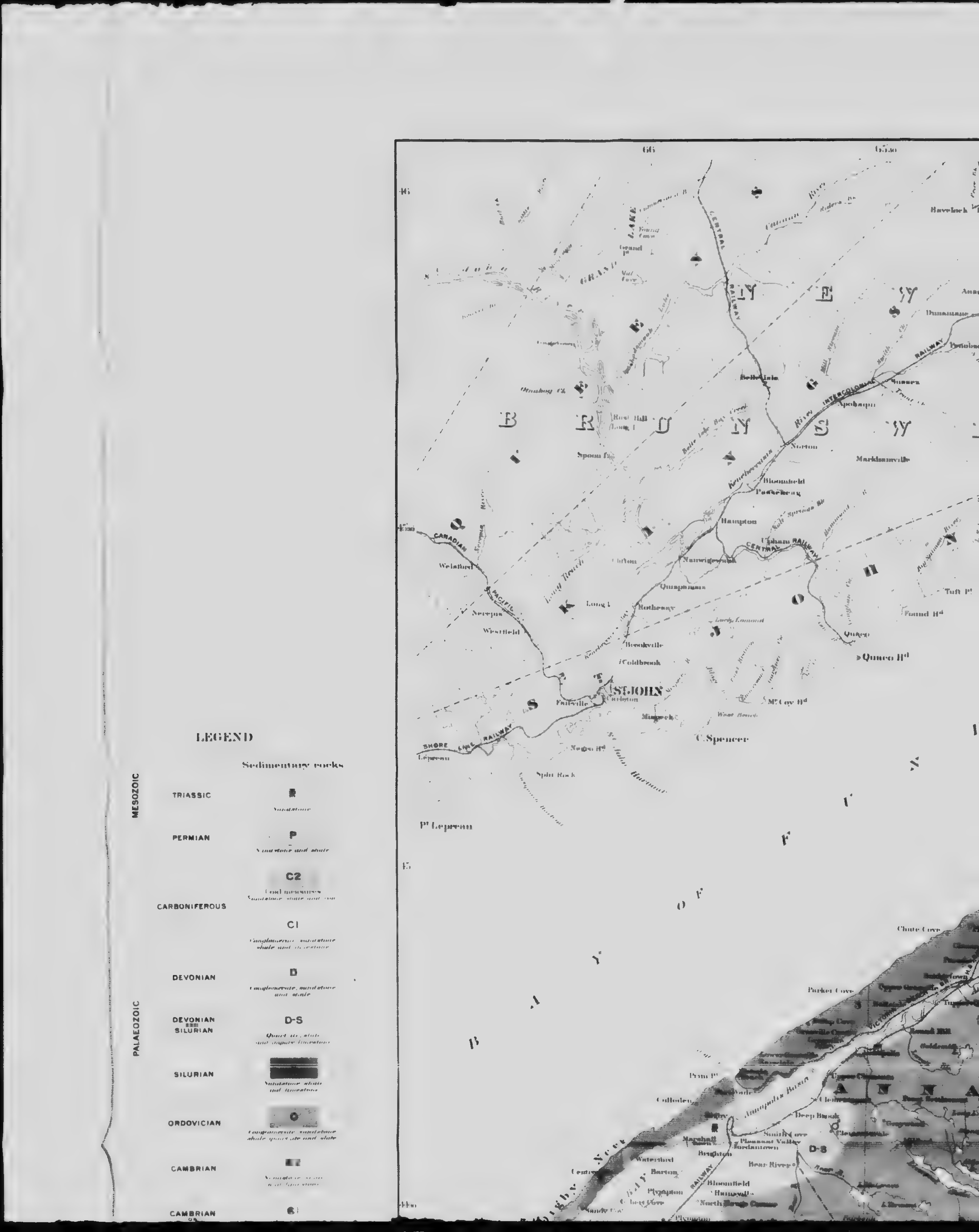
NOTE. Individual Maps or Reports will be furnished free to *bona fide* Canadian applicants.

Reports and Maps may be ordered by the numbers prefixed to titles.

Applications should be addressed to The Director, Geological Survey, Department of Mines, Ottawa.



CANADA
RAILWAY
Salisbury
Havelock
Elgin
RAILWAY
66



LEGEND
Sedimentary rocks
MESOZOIC
TRIASSIC
PERMIAN
Sandstone and shale
CARBONIFEROUS
C2
C1
DEVONIAN
D
DEVONIAN SILURIAN
D-S
SILURIAN
ORDOVICIAN
O
CAMBRIAN
CAMBRIAN
PALAEOZOIC
66
Havelock
GRAND LAKE
CENTRAL RAILWAY
INTERCOLONIAL RAILWAY
Apohaqui
Sussex
Norton
Markhamville
Bloomfield
Passekeag
Hampton
CENTRAL RAILWAY
Nauwigewauk
Quispamsis
Rothesay
Clifton
Long I
Spoon I
CANADIAN PACIFIC
Welsford
Nerepis
Westfield
Brookville
Coldbrook
ST. JOHN
Carleton
Fairville
Quaco
Quaco Hd
Tufts Pt
C. Spencer
SHORE LINE RAILWAY
Lepreau
Split Rock
Pt Lepreau
Chute Cove
Parker Cove
Annapolis Basin
Culloden
Deep Brook
Smith's Cove
Brighton
Bear River
Barton
Plympton
Bloomfield
D-S

Canada
Department of Mines
GEOLOGICAL SURVEY
1911

Department of Mines

LEGEND

Gold Districts
and Mineral Localities

Gold District

Gold

Antimony

Argentiferous Galena

Arsenic

Barite

Building stone
Sandstone and Granite

Clay

Coal

Copper

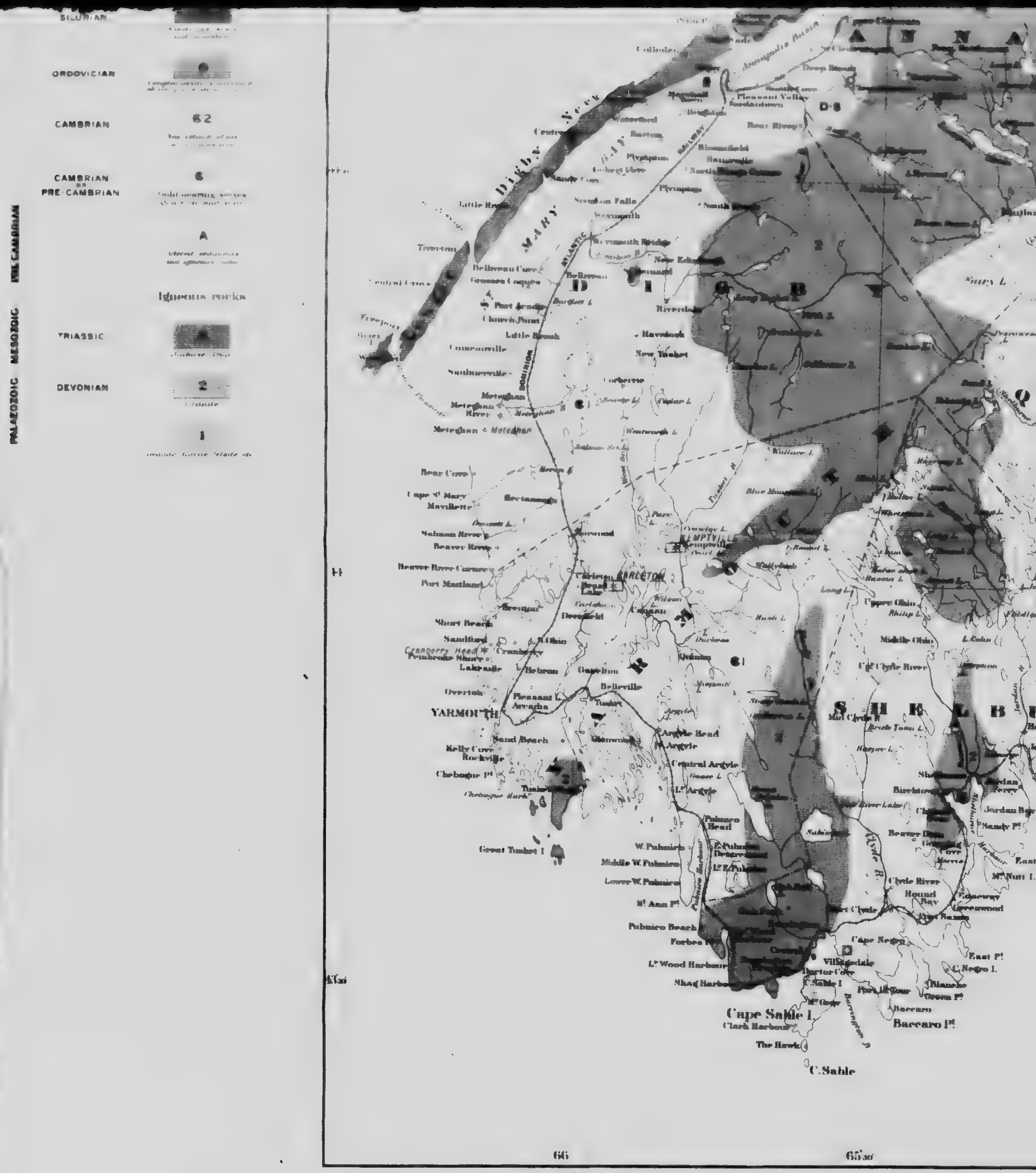
Fluorspar

Grindstone

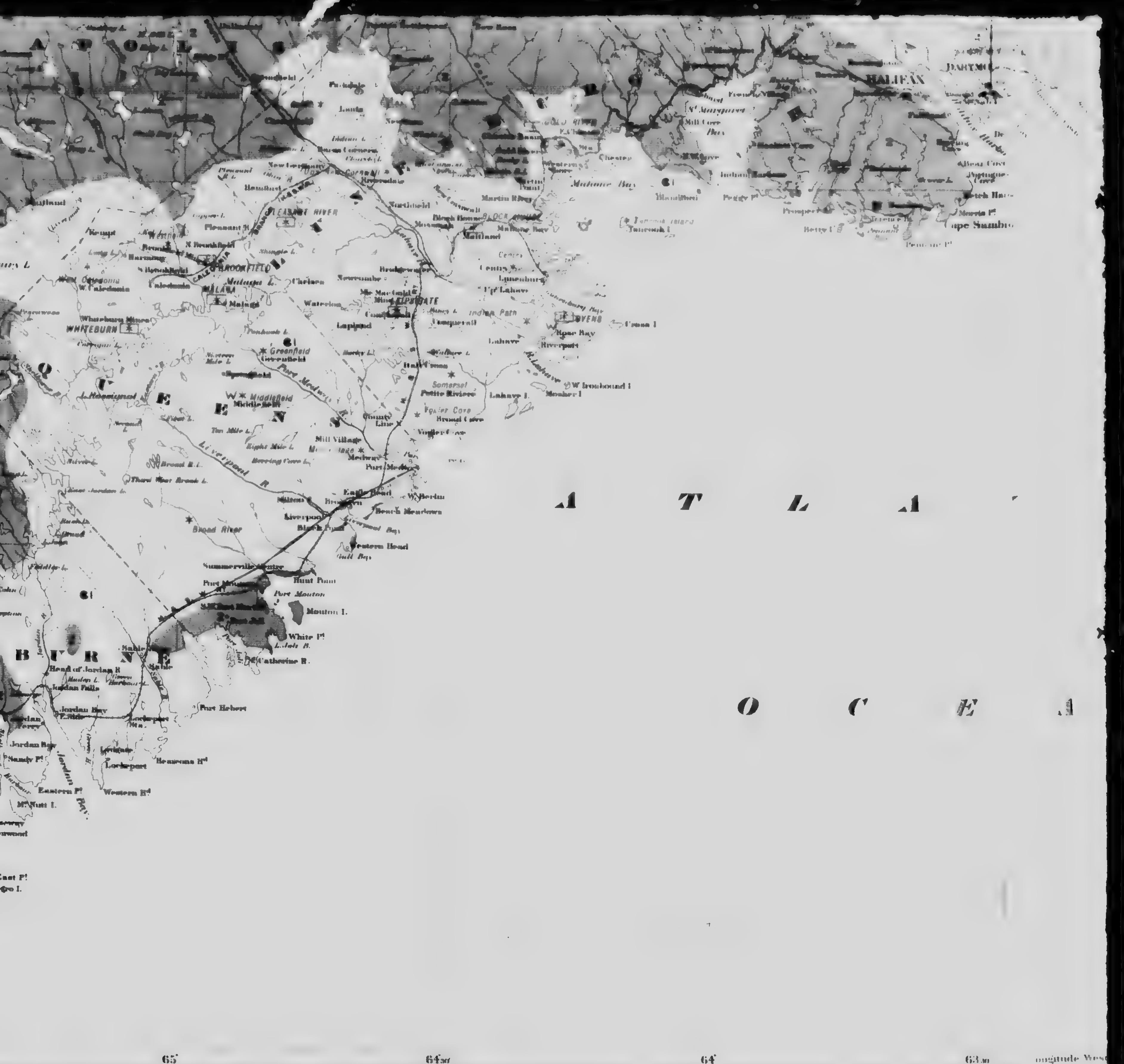
Gypsum

Infusorial earth

Iron



C O Senecal, *Geographer and Chief Draughtsman.*



MAP 39A

Geological Map of

NOVA SCOTI

Scale, $\frac{1}{506,880}$

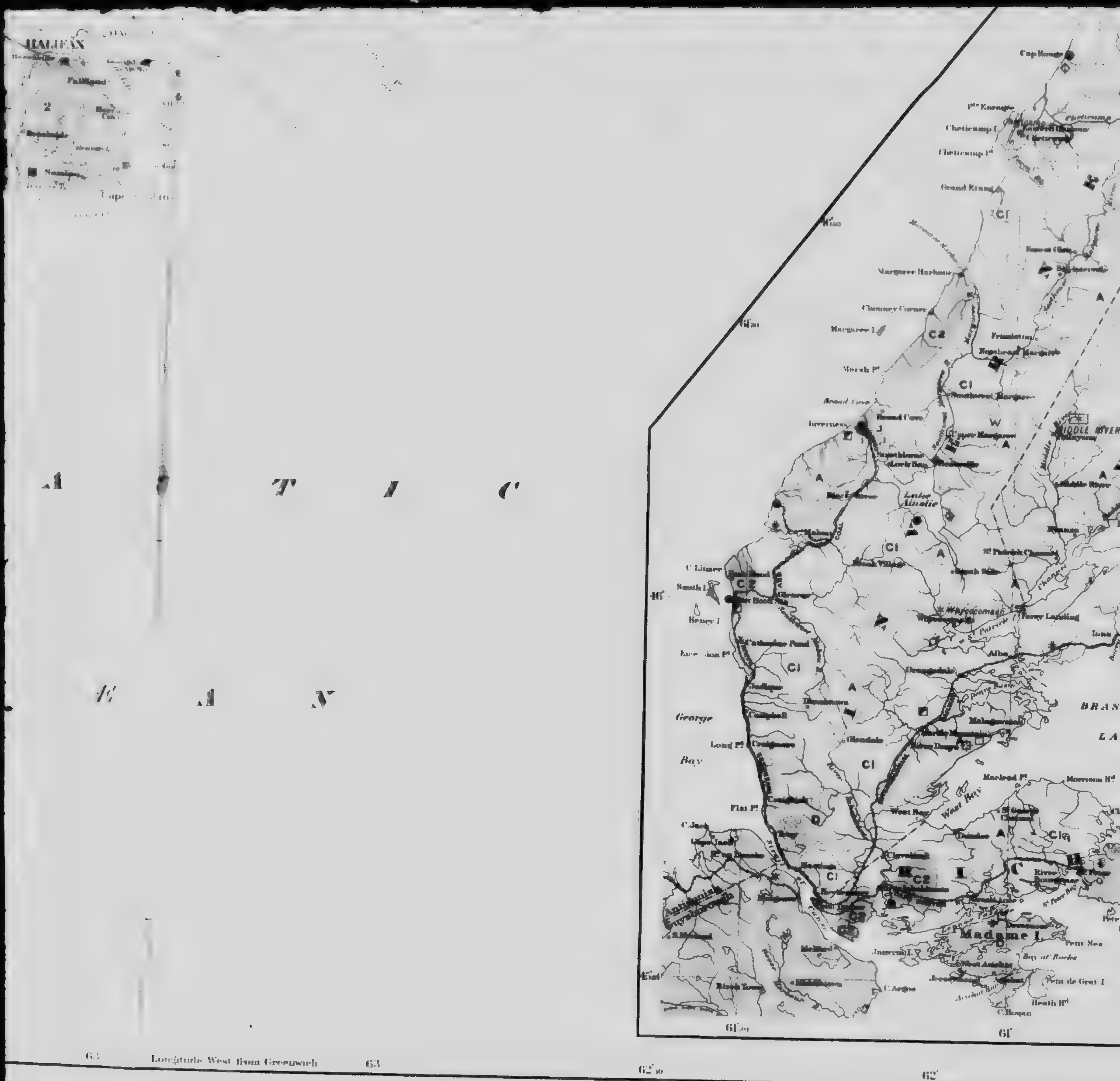
Miles

10 — 0 — 10

Kilometres

10 — 0 — 10 — 20 — 30

8 MILES TO 1 INCH



MAP 39A

Geological Map of

NA SCOTIA

Scale, $\frac{1}{506,880}$

Miles

10 20 30

Kilometres

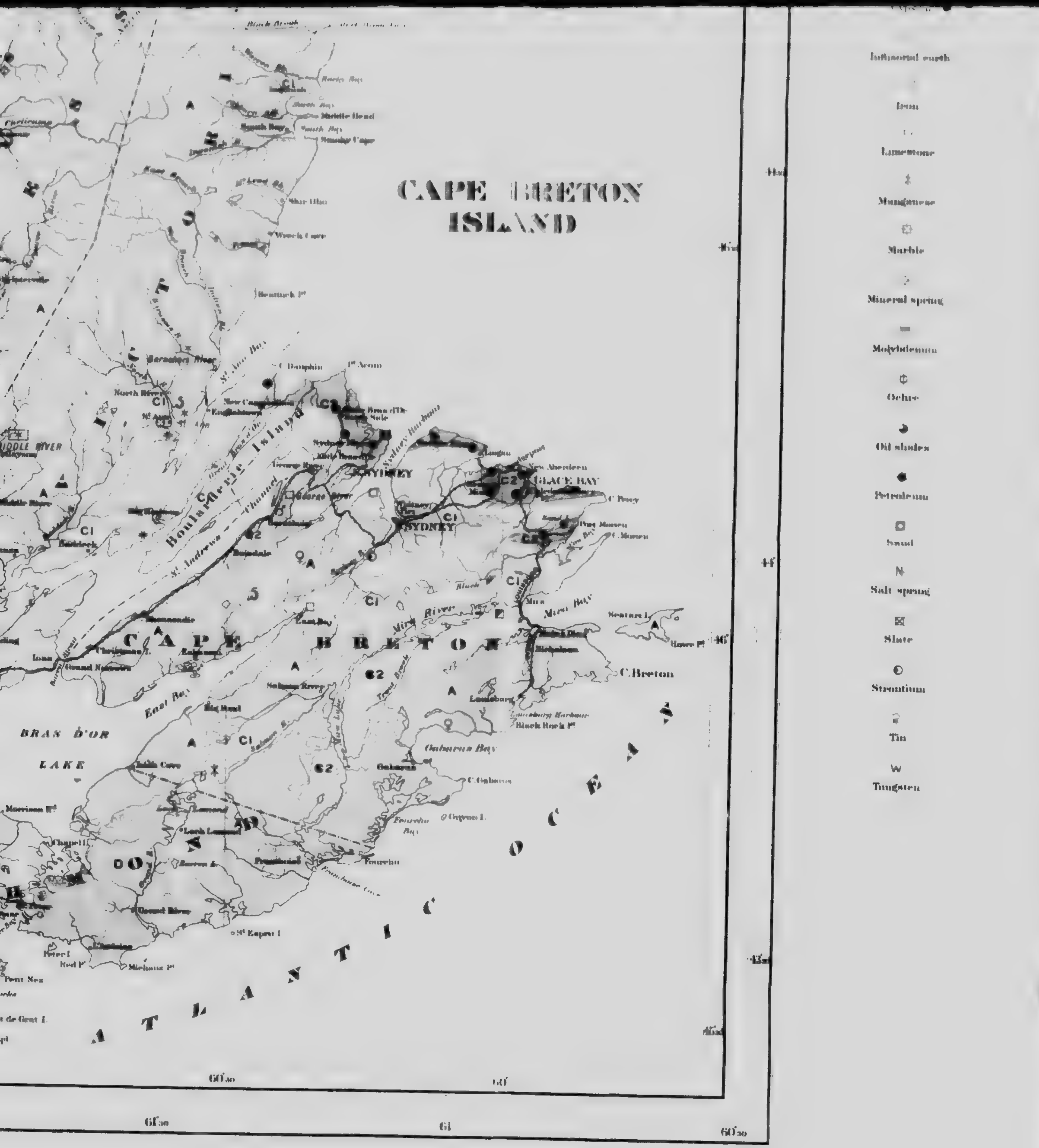
10 20 30 40

8 MILES TO 1 INCH

GEOLOGY

Hugh Fletcher, E.R. Faribault
and other officers of the Geolo...

Compilation by A.Dickison a...



GEOLOGY

E.R. Faribault, L.W. Bailey.
of the Geological Survey.

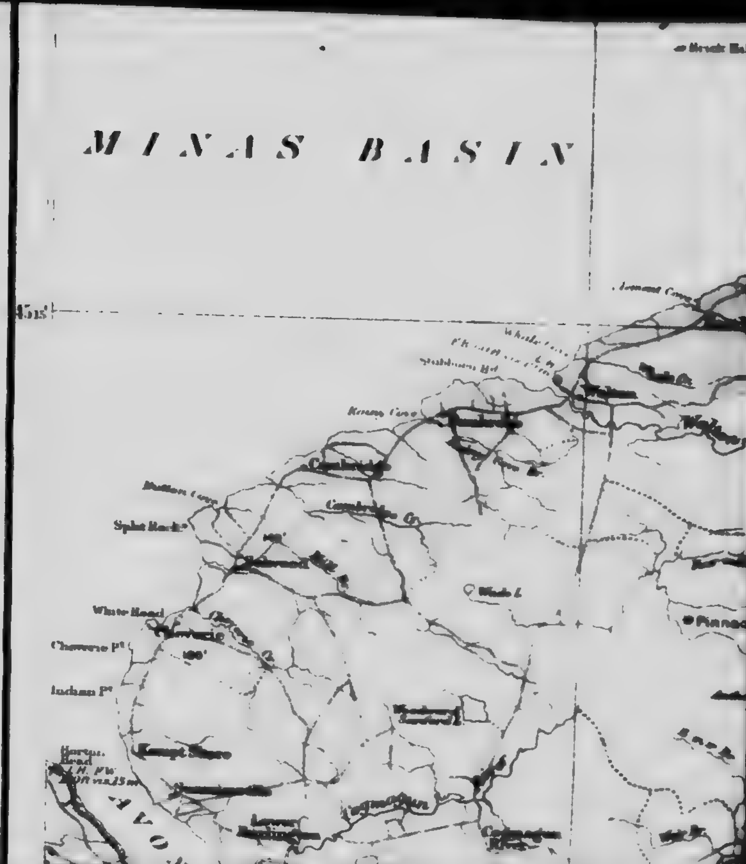
A. Dickison and A.S. Jost.

To accompany Memoir No 20

LEGEND

Sedimentary rocks

MESOZOIC	TRIASSIC	T	*Sandstone*
PALAEOZOIC	LOWER CARBONIFEROUS	C	*Conglomerate, sandstone shale, limestone and gypsum*
	DEVONIAN	D	*Conglomerate, sandstone and shale*
	SILURIAN		*Sandstone, shale and limestone*
	ORDOVICIAN		*Sandstone and shale*
	CAMBRIAN OR PRE-CAMBRIAN	€h	**Halifax formation** *Slate*



LEGEND

Sedimentary rocks

MESOZOIC	TRIASSIC	Sandstone
	LOWER CARBONIFEROUS	C
	DEVONIAN	D
PALAEOZOIC	SILURIAN	Sandstone shale and limestone
	ORDOVICIAN	Sandstone and shale
	CAMBRIAN or PRE-CAMBRIAN Gold bearing series	€b Halifax formation Slate
		€a Goldenville formation Quartzite and slate

Igneous rocks

MESOZOIC	TRIASSIC	Diabase Trap
PALAEOZOIC	DEVONIAN	Granite
		1 Granite diorite felsite etc

Symbols

Geological boundary

Fault

Anticline
Definitely located

Anticline
Not definitely located

Syncline
Definitely located

Syncline
Not definitely located

Dome

STRUCTURAL GEOLOGY

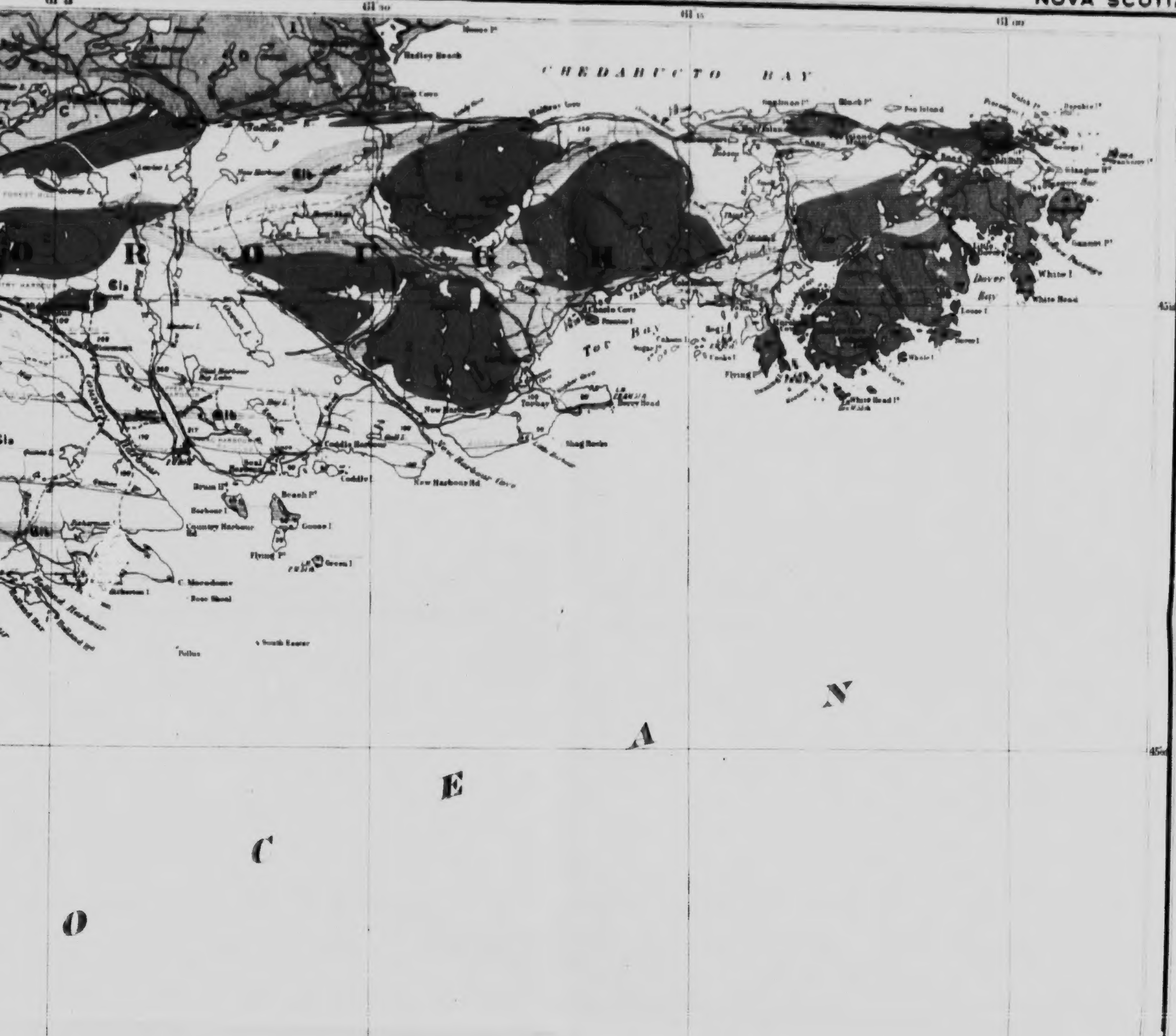
Department of
GEOLOGIC SU

Canada
Department of Mines
GEOLOGICAL SURVEY

Hon. W. Templeman Minister, A.P. Low Deputy Minister
R.W. Brock Director

1911

NOVA SCOTIA


CHEDABUCTO BAY
Hadley Beach
Tor Bay
Dover Bay
White Head
New Harbour
Country Harbour
Goose I
Green I
Pollux
O C E A N
Base of Slate Division
Base of Slate Division

C.O.Senécal, Geographer and Chief Draughtsman
A.Pickison and A.S.Jost, Draughtsmen

MAP 53A

SOUTHEAST NO

Scale, 1/250000

Miles

10 5 0

Kilometres

10 5 0

Note. For practical
4 MILES TO

1208

Base map from the engraved plates of the Department of the Interior

MAP 53A

HEAST NOVA SCOTIA

Scale, $\frac{1}{250000}$

Miles

Kilometres

Note. For practical purposes assume
4 MILES TO 1 INCH

GEOLOGY AND TOPOGRAPHY

HUGH FLETCHER	1882 - 1907
E. R. FARIBAULT	1882 - 1907

To accompany Memoir No 20